SEQUENCE LISTING

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<120> PUFA Polyketide Synthase Systems and Uses Thereof

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<210> 1
<211> 8730
<212> DNA
<213> Schizochytrium sp.

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Met Ala Ala Arg Leu Gln Glu Gln Lys Gly Gly Glu Met Asp Thr Arg
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att gcc atc atc ggc atg tcg gcc atc ctc ccc tgc ggc acg acc gtg   96
Ile Ala Ile Ile Gly Met Ser Ala Ile Leu Pro Cys Gly Thr Thr Val
                20   25   30

cgc gag tcg tgg gag acc atc cgc gcc ggc atc gac tgc ctg tcg gat   144
Arg Glu Ser Trp Glu Thr Ile Arg Ala Gly Ile Asp Cys Leu Ser Asp
            35   40   45

ctc ccc gag gac cgc gtc gac gtg acg gcg tac ttt gac ccc gtc aag   192
Leu Pro Glu Asp Arg Val Asp Val Thr Ala Tyr Phe Asp Pro Val Lys
        50   55   60

acc acc aag gac aag atc tac tgc aag cgc ggt ggc ttc att ccc gag   240
Thr Thr Lys Asp Lys Ile Tyr Cys Lys Arg Gly Gly Phe Ile Pro Glu
65   70   75   80

tac gac ttt gac gcc cgc gag ttc gga ctc aac atg ttc cag atg gag   288
Tyr Asp Phe Asp Ala Arg Glu Phe Gly Leu Asn Met Phe Gln Met Glu
                85   90   95

gac tcg gac gca aac cag acc atc tcg ctt ctc aag gtc aag gag gcc   336
Asp Ser Asp Ala Asn Gln Thr Ile Ser Leu Leu Lys Val Lys Glu Ala
                100   105   110

ctc cag gac gcc ggc atc gac gcc ctc ggc aag gaa aag aag aac atc   384
Leu Gln Asp Ala Gly Ile Asp Ala Leu Gly Lys Glu Lys Lys Asn Ile
            115   120   125

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ggc tgc gtg ctc ggc att ggc ggc ggc caa aag tcc agc cac gag ttc      432
Gly Cys Val Leu Gly Ile Gly Gly Gly Gln Lys Ser Ser His Glu Phe
        130             135             140

tac tcg cgc ctt aat tat gtt gtc gtg gag aag gtc ctc cgc aag atg      480
Tyr Ser Arg Leu Asn Tyr Val Val Val Glu Lys Val Leu Arg Lys Met
145             150             155             160

ggc atg ccc gag gag gac gtc aag gtc gcc gtc gaa aag tac aag gcc      528
Gly Met Pro Glu Glu Asp Val Lys Val Ala Val Glu Lys Tyr Lys Ala
                165             170             175

aac ttc ccc gag tgg cgc ctc gac tcc ttc cct ggc ttc ctc ggc aac      576
Asn Phe Pro Glu Trp Arg Leu Asp Ser Phe Pro Gly Phe Leu Gly Asn
                180             185             190

gtc acc gcc ggt cgc tgc acc aac acc ttc aac ctc gac ggc atg aac      624
Val Thr Ala Gly Arg Cys Thr Asn Thr Phe Asn Leu Asp Gly Met Asn
        195             200             205

tgc gtt gtc gac gcc gca tgc gcc tcg tcc ctc atc gcc gtc aag gtc      672
Cys Val Val Asp Ala Ala Cys Ala Ser Ser Leu Ile Ala Val Lys Val
        210             215             220

gcc atc gac gag ctg ctc tac ggt gac tgc gac atg atg gtc acc ggt      720
Ala Ile Asp Glu Leu Leu Tyr Gly Asp Cys Asp Met Met Val Thr Gly
225             230             235             240

gcc acc tgc acg gat aac tcc atc ggc atg tac atg gcc ttc tcc aag      768
Ala Thr Cys Thr Asp Asn Ser Ile Gly Met Tyr Met Ala Phe Ser Lys
                245             250             255

acc ccc gtg ttc tcc acg gac ccc agc gtg cgc gcc tac gac gaa aag      816
Thr Pro Val Phe Ser Thr Asp Pro Ser Val Arg Ala Tyr Asp Glu Lys
                260             265             270

aca aag ggc atg ctc atc ggc gag ggc tcc gcc atg ctc gtc ctc aag      864
Thr Lys Gly Met Leu Ile Gly Glu Gly Ser Ala Met Leu Val Leu Lys
                275             280             285

cgc tac gcc gac gcc gtc cgc gac ggc gat gag atc cac gct gtt att      912
Arg Tyr Ala Asp Ala Val Arg Asp Gly Asp Glu Ile His Ala Val Ile
        290             295             300

cgc ggc tgc gcc tcc tcc agt gat ggc aag gcc gcc ggc atc tac acg      960
Arg Gly Cys Ala Ser Ser Ser Asp Gly Lys Ala Ala Gly Ile Tyr Thr
305             310             315             320

ccc acc att tcg ggc cag gag gag gcc ctc cgc cgc gcc tac aac cgc     1008
Pro Thr Ile Ser Gly Gln Glu Glu Ala Leu Arg Arg Ala Tyr Asn Arg
                325             330             335

gcc tgt gtc gac ccg gcc acc gtc act ctc gtc gag ggt cac ggc acc     1056
Ala Cys Val Asp Pro Ala Thr Val Thr Leu Val Glu Gly His Gly Thr
                340             345             350

ggt act ccc gtt ggc gac cgc atc gag ctc acc gcc ttg cgc aac ctc     1104
Gly Thr Pro Val Gly Asp Arg Ile Glu Leu Thr Ala Leu Arg Asn Leu
        355             360             365

ttt gac aag gcc tac ggc gag ggc aac acc gaa aag gtc gct gtg ggc     1152
Phe Asp Lys Ala Tyr Gly Glu Gly Asn Thr Glu Lys Val Ala Val Gly
        370             375             380

agc atc aag tcc agc atc ggc cat ctc aag gcc gtc gcc ggt ctc gcc     1200
Ser Ile Lys Ser Ser Ile Gly His Leu Lys Ala Val Ala Gly Leu Ala
385             390             395             400

ggt atg atc aag gtc atc atg gcg ctc aag cac aag act ctc ccg ggc     1248
Gly Met Ile Lys Val Ile Met Ala Leu Lys His Lys Thr Leu Pro Gly
                405             410             415
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acc atc aac gtc gac aac cca ccc aac ctc tac gac aac acg ccc atc          1296
Thr Ile Asn Val Asp Asn Pro Pro Asn Leu Tyr Asp Asn Thr Pro Ile
            420             425                 430

aac gag tcc tcg ctc tac att aac acc atg aac cgc ccc tgg ttc ccg          1344
Asn Glu Ser Ser Leu Tyr Ile Asn Thr Met Asn Arg Pro Trp Phe Pro
            435             440                 445

ccc cct ggt gtg ccc cgc cgc gcc ggc att tcg agc ttt ggc ttt ggt          1392
Pro Pro Gly Val Pro Arg Arg Ala Gly Ile Ser Ser Phe Gly Phe Gly
            450             455                 460

ggc gcc aac tac cac gcc gtc ctc gag gag gcc gag ccc gag cac acg          1440
Gly Ala Asn Tyr His Ala Val Leu Glu Glu Ala Glu Pro Glu His Thr
465             470             475                 480

acc gcg tac cgc ctc aac aag cgc ccg cag ccc gtg ctc atg atg gcc          1488
Thr Ala Tyr Arg Leu Asn Lys Arg Pro Gln Pro Val Leu Met Met Ala
            485             490                 495

gcc acg ccc gcg gcc ctc cag tcg ctc tgc gag gcc cag ctc aag gag          1536
Ala Thr Pro Ala Ala Leu Gln Ser Leu Cys Glu Ala Gln Leu Lys Glu
            500             505                 510

ttc gag gcc gcc atc aag gag aac gag acc gtc aag aac acc gcc tac          1584
Phe Glu Ala Ala Ile Lys Glu Asn Glu Thr Val Lys Asn Thr Ala Tyr
            515             520                 525

atc aag tgc gtc aag ttc ggc gag cag ttc aaa ttc cct ggc tcc atc          1632
Ile Lys Cys Val Lys Phe Gly Glu Gln Phe Lys Phe Pro Gly Ser Ile
            530             535                 540

ccg gcc aca aac gcg cgc ctc ggc ttc ctc gtc aag gat gct gag gat          1680
Pro Ala Thr Asn Ala Arg Leu Gly Phe Leu Val Lys Asp Ala Glu Asp
545             550             555                 560

gcc tgc tcc acc ctc cgt gcc atc tgc gcc caa ttc gcc aag gat gtc          1728
Ala Cys Ser Thr Leu Arg Ala Ile Cys Ala Gln Phe Ala Lys Asp Val
            565             570                 575

acc aag gag gcc tgg cgc ctc ccc cgc gag ggc gtc agc ttc cgc gcc          1776
Thr Lys Glu Ala Trp Arg Leu Pro Arg Glu Gly Val Ser Phe Arg Ala
            580             585                 590

aag ggc atc gcc acc aac ggc gct gtc gcc gcg ctc ttc tcc ggc cag          1824
Lys Gly Ile Ala Thr Asn Gly Ala Val Ala Ala Leu Phe Ser Gly Gln
            595             600                 605

ggc gcg cag tac acg cac atg ttt agc gag gtg gcc atg aac tgg ccc          1872
Gly Ala Gln Tyr Thr His Met Phe Ser Glu Val Ala Met Asn Trp Pro
            610             615                 620

cag ttc cgc cag agc att gcc gcc atg gac gcc gcc cag tcc aag gtc          1920
Gln Phe Arg Gln Ser Ile Ala Ala Met Asp Ala Ala Gln Ser Lys Val
625             630             635                 640

gct gga agc gac aag gac ttt gag cgc gtc tcc cag gtc ctc tac ccg          1968
Ala Gly Ser Asp Lys Asp Phe Glu Arg Val Ser Gln Val Leu Tyr Pro
            645             650                 655

cgc aag ccg tac gag cgt gag ccc gag cag aac ccc aag aag atc tcc          2016
Arg Lys Pro Tyr Glu Arg Glu Pro Glu Gln Asn Pro Lys Lys Ile Ser
            660             665                 670

ctc acc gcc tac tcg cag ccc tcg acc ctg gcc tgc gct ctc ggt gcc          2064
Leu Thr Ala Tyr Ser Gln Pro Ser Thr Leu Ala Cys Ala Leu Gly Ala
            675             680                 685
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ttt gag atc ttc aag gag gcc ggc ttc acc ccg gac ttt gcc gcc ggc      2112
Phe Glu Ile Phe Lys Glu Ala Gly Phe Thr Pro Asp Phe Ala Ala Gly
    690             695             700

cat tcg ctc ggt gag ttc gcc gcc ctc tac gcc gcg ggc tgc gtc gac      2160
His Ser Leu Gly Glu Phe Ala Ala Leu Tyr Ala Ala Gly Cys Val Asp
705             710             715                 720

cgc gac gag ctc ttt gag ctt gtc tgc cgc cgc gcc cgc atc atg ggc      2208
Arg Asp Glu Leu Phe Glu Leu Val Cys Arg Arg Ala Arg Ile Met Gly
            725             730             735

ggc aag gac gca ccg gcc acc ccc aag gga tgc atg gcc gcc gtc att      2256
Gly Lys Asp Ala Pro Ala Thr Pro Lys Gly Cys Met Ala Ala Val Ile
        740             745             750

ggc ccc aac gcc gag aac atc aag gtc cag gcc gcc aac gtc tgg ctc      2304
Gly Pro Asn Ala Glu Asn Ile Lys Val Gln Ala Ala Asn Val Trp Leu
        755             760             765

ggc aac tcc aac tcg cct tcg cag acc gtc atc acc ggc tcc gtc gaa      2352
Gly Asn Ser Asn Ser Pro Ser Gln Thr Val Ile Thr Gly Ser Val Glu
        770             775             780

ggt atc cag gcc gag agc gcc cgc ctc cag aag gag ggc ttc cgc gtc      2400
Gly Ile Gln Ala Glu Ser Ala Arg Leu Gln Lys Glu Gly Phe Arg Val
785             790             795             800

gtg cct ctt gcc tgc gag agc gcc ttc cac tcg ccc cag atg gag aac      2448
Val Pro Leu Ala Cys Glu Ser Ala Phe His Ser Pro Gln Met Glu Asn
            805             810             815

gcc tcg tcg gcc ttc aag gac gtc atc tcc aag gtc tcc ttc cgc acc      2496
Ala Ser Ser Ala Phe Lys Asp Val Ile Ser Lys Val Ser Phe Arg Thr
        820             825             830

ccc aag gcc gag acc aag ctc ttc agc aac gtc tct ggc gag acc tac      2544
Pro Lys Ala Glu Thr Lys Leu Phe Ser Asn Val Ser Gly Glu Thr Tyr
        835             840             845

ccc acg gac gcc cgc gag atg ctt acg cag cac atg acc agc agc gtc      2592
Pro Thr Asp Ala Arg Glu Met Leu Thr Gln His Met Thr Ser Ser Val
    850             855             860

aag ttc ctc acc cag gtc cgc aac atg cac cag gcc ggt gcg cgc atc      2640
Lys Phe Leu Thr Gln Val Arg Asn Met His Gln Ala Gly Ala Arg Ile
865             870             875             880

ttt gtc gag ttc gga ccc aag cag gtg ctc tcc aag ctt gtc tcc gag      2688
Phe Val Glu Phe Gly Pro Lys Gln Val Leu Ser Lys Leu Val Ser Glu
            885             890             895

acc ctc aag gat gac ccc tcg gtt gtc acc gtc tct gtc aac ccg gcc      2736
Thr Leu Lys Asp Asp Pro Ser Val Val Thr Val Ser Val Asn Pro Ala
        900             905             910

tcg ggc acg gat tcg gac atc cag ctc cgc gac gcg gcc gtc cag ctc      2784
Ser Gly Thr Asp Ser Asp Ile Gln Leu Arg Asp Ala Ala Val Gln Leu
        915             920             925

gtt gtc gct ggc gtc aac ctt cag ggc ttt gac aag tgg gac gcc ccc      2832
Val Val Ala Gly Val Asn Leu Gln Gly Phe Asp Lys Trp Asp Ala Pro
    930             935             940

gat gcc acc cgc atg cag gcc atc aag aag aag cgc act acc ctc cgc      2880
Asp Ala Thr Arg Met Gln Ala Ile Lys Lys Lys Arg Thr Thr Leu Arg
945             950             955             960
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ctt tcg gcc gcc acc tac gtc tcg gac aag acc aag aag gtc cgc gac      2928
Leu Ser Ala Ala Thr Tyr Val Ser Asp Lys Thr Lys Lys Val Arg Asp
                965                     970                 975

gcc gcc atg aac gat ggc cgc tgc gtc acc tac ctc aag ggc gcc gca      2976
Ala Ala Met Asn Asp Gly Arg Cys Val Thr Tyr Leu Lys Gly Ala Ala
                980                 985                 990

ccg ctc atc aag gcc ccg gag ccc gtt gtc gac gag gcc gcc aag cgc      3024
Pro Leu Ile Lys Ala Pro Glu Pro Val Val Asp Glu Ala Ala Lys Arg
                995             1000                1005

gag gcc gag cgt ctc cag aag gag ctt cag gat gcc cag cgc cag          3069
Glu Ala Glu Arg Leu Gln Lys Glu Leu Gln Asp Ala Gln Arg Gln
    1010            1015                1020

ctc gac gac gcc aag cgc gcc gcc gcc gag gcc aac tcc aag ctc          3114
Leu Asp Asp Ala Lys Arg Ala Ala Ala Glu Ala Asn Ser Lys Leu
    1025            1030                1035

gcc gct gcc aag gag gag gcc aag acc gcc gct gct tcg gcc aag          3159
Ala Ala Ala Lys Glu Glu Ala Lys Thr Ala Ala Ala Ser Ala Lys
    1040            1045                1050

ccc gca gtt gac act gct gtt gtc gaa aag cat cgt gcc atc ctc          3204
Pro Ala Val Asp Thr Ala Val Val Glu Lys His Arg Ala Ile Leu
    1055            1060                1065

aag tcc atg ctc gcg gag ctc gat ggc tac gga tcg gtc gac gct          3249
Lys Ser Met Leu Ala Glu Leu Asp Gly Tyr Gly Ser Val Asp Ala
    1070            1075                1080

tct tcc ctc cag cag cag cag cag cag cag acg gcc ccc gcc ccg          3294
Ser Ser Leu Gln Gln Gln Gln Gln Gln Gln Thr Ala Pro Ala Pro
    1085            1090                1095

gtc aag gct gct gcg cct gcc gcc ccc gtt gcc tcg gcc cct gcc          3339
Val Lys Ala Ala Ala Pro Ala Ala Pro Val Ala Ser Ala Pro Ala
    1100            1105                1110

ccg gct gtc tcg aac gag ctt ctt gag aag gcc gag act gtc gtc          3384
Pro Ala Val Ser Asn Glu Leu Leu Glu Lys Ala Glu Thr Val Val
    1115            1120                1125

atg gag gtc ctc gcc gcc aag acc ggc tac gag acc gac atg atc          3429
Met Glu Val Leu Ala Ala Lys Thr Gly Tyr Glu Thr Asp Met Ile
    1130            1135                1140

gag gct gac atg gag ctc gag acc gag ctc ggc att gac tcc atc          3474
Glu Ala Asp Met Glu Leu Glu Thr Glu Leu Gly Ile Asp Ser Ile
    1145            1150                1155

aag cgt gtc gag atc ctc tcc gag gtc cag gcc atg ctc aat gtc          3519
Lys Arg Val Glu Ile Leu Ser Glu Val Gln Ala Met Leu Asn Val
    1160            1165                1170

gag gcc aag gat gtc gat gcc ctc agc cgc act cgc act gtt ggt          3564
Glu Ala Lys Asp Val Asp Ala Leu Ser Arg Thr Arg Thr Val Gly
    1175            1180                1185

gag gtt gtc aac gcc atg aag gcc gag atc gct ggc agc tct gcc          3609
Glu Val Val Asn Ala Met Lys Ala Glu Ile Ala Gly Ser Ser Ala
    1190            1195                1200

ccg gcg cct gct gcc gct gct ccg gct ccg gcc aag gct gcc cct          3654
Pro Ala Pro Ala Ala Ala Ala Pro Ala Pro Ala Lys Ala Ala Pro
    1205            1210                1215
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gcc gcc gct gcg cct gct gtc   tcg aac gag ctt ctc   gag aag gcc        3699
Ala Ala Ala Ala Pro Ala Val   Ser Asn Glu Leu Leu   Glu Lys Ala
    1220             1225                    1230

gag acc gtc gtc atg gag gtc   ctc gcc gcc aag act   ggc tac gag        3744
Glu Thr Val Val Met Glu Val   Leu Ala Ala Lys Thr   Gly Tyr Glu
    1235             1240                    1245

act gac atg atc gag tcc gac   atg gag ctc gag act   gag ctc ggc        3789
Thr Asp Met Ile Glu Ser Asp   Met Glu Leu Glu Thr   Glu Leu Gly
    1250             1255                    1260

att gac tcc atc aag cgt gtc   gag atc ctc tcc gag   gtt cag gcc        3834
Ile Asp Ser Ile Lys Arg Val   Glu Ile Leu Ser Glu   Val Gln Ala
    1265             1270                    1275

atg ctc aac gtc gag gcc aag   gac gtc gac gct ctc   agc cgc act        3879
Met Leu Asn Val Glu Ala Lys   Asp Val Asp Ala Leu   Ser Arg Thr
    1280             1285                    1290

cgc act gtg ggt gag gtc gtc   aac gcc atg aag gct   gag atc gct        3924
Arg Thr Val Gly Glu Val Val   Asn Ala Met Lys Ala   Glu Ile Ala
    1295             1300                    1305

ggt ggc tct gcc ccg gcg cct   gcc gcc gct gcc cca   ggt ccg gct        3969
Gly Gly Ser Ala Pro Ala Pro   Ala Ala Ala Ala Pro   Gly Pro Ala
    1310             1315                    1320

gct gcc gcc cct gcg cct gcc   gcc gcc gcc cct gct   gtc tcg aac        4014
Ala Ala Ala Pro Ala Pro Ala   Ala Ala Ala Pro Ala   Val Ser Asn
    1325             1330                    1335

gag ctt ctt gag aag gcc gag   acc gtc gtc atg gag   gtc ctc gcc        4059
Glu Leu Leu Glu Lys Ala Glu   Thr Val Val Met Glu   Val Leu Ala
    1340             1345                    1350

gcc aag act ggc tac gag act   gac atg atc gag tcc   gac atg gag        4104
Ala Lys Thr Gly Tyr Glu Thr   Asp Met Ile Glu Ser   Asp Met Glu
    1355             1360                    1365

ctc gag acc gag ctc ggc att   gac tcc atc aag cgt   gtc gag att        4149
Leu Glu Thr Glu Leu Gly Ile   Asp Ser Ile Lys Arg   Val Glu Ile
    1370             1375                    1380

ctc tcc gag gtc cag gcc atg   ctc aac gtc gag gcc   aag gac gtc        4194
Leu Ser Glu Val Gln Ala Met   Leu Asn Val Glu Ala   Lys Asp Val
    1385             1390                    1395

gac gct ctc agc cgc acc cgc   act gtt ggc gag gtc   gtc gat gcc        4239
Asp Ala Leu Ser Arg Thr Arg   Thr Val Gly Glu Val   Val Asp Ala
    1400             1405                    1410

atg aag gcc gag atc gct ggt   ggc tct gcc ccg gcg   cct gcc gcc        4284
Met Lys Ala Glu Ile Ala Gly   Gly Ser Ala Pro Ala   Pro Ala Ala
    1415             1420                    1425

gct gct cct gct ccg gct gct   gcc gcc cct gcg cct   gcc gcc cct        4329
Ala Ala Pro Ala Pro Ala Ala   Ala Ala Pro Ala Pro   Ala Ala Pro
    1430             1435                    1440

gcg cct gct gtc tcg agc gag   ctt ctc gag aag gcc   gag act gtc        4374
Ala Pro Ala Val Ser Ser Glu   Leu Leu Glu Lys Ala   Glu Thr Val
    1445             1450                    1455

gtc atg gag gtc ctc gcc gcc   aag act ggc tac gag   act gac atg        4419
Val Met Glu Val Leu Ala Ala   Lys Thr Gly Tyr Glu   Thr Asp Met
    1460             1465                    1470      /
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atc gag  tcc gac atg gag ctc  gag acc gag ctc ggc  att gac tcc        4464
Ile Glu  Ser Asp Met Glu Leu  Glu Thr Glu Leu Gly  Ile Asp Ser
    1475             1480                   1485

atc aag  cgt gtc gag att ctc  tcc gag gtc cag gcc  atg ctc aac        4509
Ile Lys  Arg Val Glu Ile Leu  Ser Glu Val Gln Ala  Met Leu Asn
    1490             1495                   1500

gtc gag  gcc aag gac gtc gac  gct ctc agc cgc acc  cgc act gtt        4554
Val Glu  Ala Lys Asp Val Asp  Ala Leu Ser Arg Thr  Arg Thr Val
    1505             1510                   1515

ggc gag  gtc gtc gat gcc atg  aag gcc gag atc gct  ggt ggc tct        4599
Gly Glu  Val Val Asp Ala Met  Lys Ala Glu Ile Ala  Gly Gly Ser
    1520             1525                   1530

gcc ccg  gcg cct gcc gcc gct  gct cct gct ccg gct  gct gcc gcc        4644
Ala Pro  Ala Pro Ala Ala Ala  Ala Pro Ala Pro Ala  Ala Ala Ala
    1535             1540                   1545

cct gcg  cct gcc gcc cct gcg  cct gcc gcc cct gcg  cct gct gtc        4689
Pro Ala  Pro Ala Ala Pro Ala  Pro Ala Ala Pro Ala  Pro Ala Val
    1550             1555                   1560

tcg agc  gag ctt ctc gag aag  gcc gag act gtc gtc  atg gag gtc        4734
Ser Ser  Glu Leu Leu Glu Lys  Ala Glu Thr Val Val  Met Glu Val
    1565             1570                   1575

ctc gcc  gcc aag act ggc tac  gag act gac atg att  gag tcc gac        4779
Leu Ala  Ala Lys Thr Gly Tyr  Glu Thr Asp Met Ile  Glu Ser Asp
    1580             1585                   1590

atg gag  ctc gag acc gag ctc  ggc att gac tcc atc  aag cgt gtc        4824
Met Glu  Leu Glu Thr Glu Leu  Gly Ile Asp Ser Ile  Lys Arg Val
    1595             1600                   1605

gag att  ctc tcc gag gtt cag  gcc atg ctc aac gtc  gag gcc aag        4869
Glu Ile  Leu Ser Glu Val Gln  Ala Met Leu Asn Val  Glu Ala Lys
    1610             1615                   1620

gac gtc  gac gct ctc agc cgc  act cgc act gtt ggt  gag gtc gtc        4914
Asp Val  Asp Ala Leu Ser Arg  Thr Arg Thr Val Gly  Glu Val Val
    1625             1630                   1635

gat gcc  atg aag gct gag atc  gct ggc agc tcc gcc  tcg gcg cct        4959
Asp Ala  Met Lys Ala Glu Ile  Ala Gly Ser Ser Ala  Ser Ala Pro
    1640             1645                   1650

gcc gcc  gct gct cct gct ccg  gct gct gcc gct cct  gcg ccc gct        5004
Ala Ala  Ala Ala Pro Ala Pro  Ala Ala Ala Ala Pro  Ala Pro Ala
    1655             1660                   1665

gcc gcc  gcc cct gct gtc tcg  aac gag ctt ctc gag  aaa gcc gag        5049
Ala Ala  Ala Pro Ala Val Ser  Asn Glu Leu Leu Glu  Lys Ala Glu
    1670             1675                   1680

act gtc  gtc atg gag gtc ctc  gcc gcc aag act ggc  tac gag act        5094
Thr Val  Val Met Glu Val Leu  Ala Ala Lys Thr Gly  Tyr Glu Thr
    1685             1690                   1695

gac atg  atc gag tcc gac atg  gag ctc gag act gag  ctc ggc att        5139
Asp Met  Ile Glu Ser Asp Met  Glu Leu Glu Thr Glu  Leu Gly Ile
    1700             1705                   1710

gac tcc  atc aag cgt gtc gag  atc ctc tcc gag gtt  cag gcc atg        5184
Asp Ser  Ile Lys Arg Val Glu  Ile Leu Ser Glu Val  Gln Ala Met
    1715             1720                   1725
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ctc aac  gtc gag gcc aag gac  gtc gat gcc ctc agc  cgc acc cgc        5229
Leu Asn  Val Glu Ala Lys Asp  Val Asp Ala Leu Ser  Arg Thr Arg
    1730             1735               1740

act gtt  ggc gag gtt gtc gat  gcc atg aag gcc gag  atc gct ggt        5274
Thr Val  Gly Glu Val Val Asp  Ala Met Lys Ala Glu  Ile Ala Gly
    1745             1750               1755

ggc tct  gcc ccg gcg cct gcc  gcc gct gcc cct gct  ccg gct gcc        5319
Gly Ser  Ala Pro Ala Pro Ala  Ala Ala Ala Pro Ala  Pro Ala Ala
    1760             1765               1770

gcc gcc  cct gct gtc tcg aac  gag ctt ctc gag aag  gcc gag act        5364
Ala Ala  Pro Ala Val Ser Asn  Glu Leu Leu Glu Lys  Ala Glu Thr
    1775             1780               1785

gtc gtc  atg gag gtc ctc gcc  gcc aag act ggc tac  gag acc gac        5409
Val Val  Met Glu Val Leu Ala  Ala Lys Thr Gly Tyr  Glu Thr Asp
    1790             1795               1800

atg atc  gag tcc gac atg gag  ctc gag acc gag ctc  ggc att gac        5454
Met Ile  Glu Ser Asp Met Glu  Leu Glu Thr Glu Leu  Gly Ile Asp
    1805             1810               1815

tcc atc  aag cgt gtc gag att  ctc tcc gag gtt cag  gcc atg ctc        5499
Ser Ile  Lys Arg Val Glu Ile  Leu Ser Glu Val Gln  Ala Met Leu
    1820             1825               1830

aac gtc  gag gcc aag gac gtc  gat gct ctc agc cgc  act cgc act        5544
Asn Val  Glu Ala Lys Asp Val  Asp Ala Leu Ser Arg  Thr Arg Thr
    1835             1840               1845

gtt ggc  gag gtc gtc gat gcc  atg aag gct gag atc  gcc ggc agc        5589
Val Gly  Glu Val Val Asp Ala  Met Lys Ala Glu Ile  Ala Gly Ser
    1850             1855               1860

tcc gcc  ccg gcg cct gcc gcc  gct gct cct gct ccg  gct gct gcc        5634
Ser Ala  Pro Ala Pro Ala Ala  Ala Ala Pro Ala Pro  Ala Ala Ala
    1865             1870               1875

gct cct  gcg ccc gct gcc gct  gcc cct gct gtc tcg  agc gag ctt        5679
Ala Pro  Ala Pro Ala Ala Ala  Ala Pro Ala Val Ser  Ser Glu Leu
    1880             1885               1890

ctc gag  aag gcc gag acc gtc  gtc atg gag gtc ctc  gcc gcc aag        5724
Leu Glu  Lys Ala Glu Thr Val  Val Met Glu Val Leu  Ala Ala Lys
    1895             1900               1905

act ggc  tac gag act gac atg  att gag tcc gac atg  gag ctc gag        5769
Thr Gly  Tyr Glu Thr Asp Met  Ile Glu Ser Asp Met  Glu Leu Glu
    1910             1915               1920

act gag  ctc ggc att gac tcc  atc aag cgt gtc gag  atc ctc tcc        5814
Thr Glu  Leu Gly Ile Asp Ser  Ile Lys Arg Val Glu  Ile Leu Ser
    1925             1930               1935

gag gtt  cag gcc atg ctc aac  gtc gag gcc aag gac  gtc gat gcc        5859
Glu Val  Gln Ala Met Leu Asn  Val Glu Ala Lys Asp  Val Asp Ala
    1940             1945               1950

ctc agc  cgc acc cgc act gtt  ggc gag gtt gtc gat  gcc atg aag        5904
Leu Ser  Arg Thr Arg Thr Val  Gly Glu Val Val Asp  Ala Met Lys
    1955             1960               1965

gcc gag  atc gct ggt ggc tct  gcc ccg gcg cct gcc  gcc gct gcc        5949
Ala Glu  Ile Ala Gly Gly Ser  Ala Pro Ala Pro Ala  Ala Ala Ala
    1970             1975               1980
```

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```
cct gct  ccg gct gcc gcc gcc  cct gct gtc tcg aac  gag ctt ctt       5994
Pro Ala  Pro Ala Ala Ala Ala  Pro Ala Val Ser Asn  Glu Leu Leu
    1985         1990              1995

gag aag  gcc gag acc gtc gtc  atg gag gtc ctc gcc  gcc aag act       6039
Glu Lys  Ala Glu Thr Val Val  Met Glu Val Leu Ala  Ala Lys Thr
    2000         2005              2010

ggc tac  gag acc gac atg atc  gag tcc gac atg gag  ctc gag acc       6084
Gly Tyr  Glu Thr Asp Met Ile  Glu Ser Asp Met Glu  Leu Glu Thr
    2015         2020              2025

gag ctc  ggc att gac tcc atc  aag cgt gtc gag att  ctc tcc gag       6129
Glu Leu  Gly Ile Asp Ser Ile  Lys Arg Val Glu Ile  Leu Ser Glu
    2030         2035              2040

gtt cag  gcc atg ctc aac gtc  gag gcc aag gac gtc  gac gct ctc       6174
Val Gln  Ala Met Leu Asn Val  Glu Ala Lys Asp Val  Asp Ala Leu
    2045         2050              2055

agc cgc  act cgc act gtt ggc  gag gtc gtc gat gcc  atg aag gct       6219
Ser Arg  Thr Arg Thr Val Gly  Glu Val Val Asp Ala  Met Lys Ala
    2060         2065              2070

gag atc  gct ggt ggc tct gcc  ccg gcg cct gcc gcc  gct gct cct       6264
Glu Ile  Ala Gly Gly Ser Ala  Pro Ala Pro Ala Ala  Ala Ala Pro
    2075         2080              2085

gcc tcg  gct ggc gcc gcg cct  gcg gtc aag att gac  tcg gtc cac       6309
Ala Ser  Ala Gly Ala Ala Pro  Ala Val Lys Ile Asp  Ser Val His
    2090         2095              2100

ggc gct  gac tgt gat gat ctt  tcc ctg atg cac gcc  aag gtg gtt       6354
Gly Ala  Asp Cys Asp Asp Leu  Ser Leu Met His Ala  Lys Val Val
    2105         2110              2115

gac atc  cgc cgc ccg gac gag  ctc atc ctg gag cgc  ccc gag aac       6399
Asp Ile  Arg Arg Pro Asp Glu  Leu Ile Leu Glu Arg  Pro Glu Asn
    2120         2125              2130

cgc ccc  gtt ctc gtt gtc gat  gac ggc agc gag ctc  acc ctc gcc       6444
Arg Pro  Val Leu Val Val Asp  Asp Gly Ser Glu Leu  Thr Leu Ala
    2135         2140              2145

ctg gtc  cgc gtc ctc ggc gcc  tgc gcc gtt gtc ctg  acc ttt gag       6489
Leu Val  Arg Val Leu Gly Ala  Cys Ala Val Val Leu  Thr Phe Glu
    2150         2155              2160

ggt ctc  cag ctc gct cag cgc  gct ggt gcc gct gcc  atc cgc cac       6534
Gly Leu  Gln Leu Ala Gln Arg  Ala Gly Ala Ala Ala  Ile Arg His
    2165         2170              2175

gtg ctc  gcc aag gat ctt tcc  gcg gag agc gcc gag  aag gcc atc       6579
Val Leu  Ala Lys Asp Leu Ser  Ala Glu Ser Ala Glu  Lys Ala Ile
    2180         2185              2190

aag gag  gcc gag cag cgc ttt  ggc gct ctc ggc ggc  ttc atc tcg       6624
Lys Glu  Ala Glu Gln Arg Phe  Gly Ala Leu Gly Gly  Phe Ile Ser
    2195         2200              2205

cag cag  gcg gag cgc ttc gag  ccc gcc gaa atc ctc  ggc ttc acg       6669
Gln Gln  Ala Glu Arg Phe Glu  Pro Ala Glu Ile Leu  Gly Phe Thr
    2210         2215              2220

ctc atg  tgc gcc aag ttc gcc  aag gct tcc ctc tgc  acg gct gtg       6714
Leu Met  Cys Ala Lys Phe Ala  Lys Ala Ser Leu Cys  Thr Ala Val
    2225         2230              2235
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gct ggc  ggc cgc ccg gcc ttt  atc ggt gtg gcg cgc  ctt gac ggc        6759
Ala Gly  Gly Arg Pro Ala Phe  Ile Gly Val Ala Arg  Leu Asp Gly
    2240                 2245                 2250

cgc ctc  gga ttc act tcg cag  ggc act tct gac gcg  ctc aag cgt        6804
Arg Leu  Gly Phe Thr Ser Gln  Gly Thr Ser Asp Ala  Leu Lys Arg
    2255                 2260                 2265

gcc cag  cgt ggt gcc atc ttt  ggc ctc tgc aag acc  atc ggc ctc        6849
Ala Gln  Arg Gly Ala Ile Phe  Gly Leu Cys Lys Thr  Ile Gly Leu
    2270                 2275                 2280

gag tgg  tcc gag tct gac gtc  ttt tcc cgc ggc gtg  gac att gct        6894
Glu Trp  Ser Glu Ser Asp Val  Phe Ser Arg Gly Val  Asp Ile Ala
    2285                 2290                 2295

cag ggc  atg cac ccc gag gat  gcc gcc gtg gcg att  gtg cgc gag        6939
Gln Gly  Met His Pro Glu Asp  Ala Ala Val Ala Ile  Val Arg Glu
    2300                 2305                 2310

atg gcg  tgc gct gac att cgc  att cgc gag gtc ggc  att ggc gca        6984
Met Ala  Cys Ala Asp Ile Arg  Ile Arg Glu Val Gly  Ile Gly Ala
    2315                 2320                 2325

aac cag  cag cgc tgc acg atc  cgt gcc gcc aag ctc  gag acc ggc        7029
Asn Gln  Gln Arg Cys Thr Ile  Arg Ala Ala Lys Leu  Glu Thr Gly
    2330                 2335                 2340

aac ccg  cag cgc cag atc gcc  aag gac gac gtg ctg  ctc gtt tct        7074
Asn Pro  Gln Arg Gln Ile Ala  Lys Asp Asp Val Leu  Leu Val Ser
    2345                 2350                 2355

ggc ggc  gct cgc ggc atc acg  cct ctt tgc atc cgg  gag atc acg        7119
Gly Gly  Ala Arg Gly Ile Thr  Pro Leu Cys Ile Arg  Glu Ile Thr
    2360                 2365                 2370

cgc cag  atc gcg ggc ggc aag  tac att ctg ctt ggc  cgc agc aag        7164
Arg Gln  Ile Ala Gly Gly Lys  Tyr Ile Leu Leu Gly  Arg Ser Lys
    2375                 2380                 2385

gtc tct  gcg agc gaa ccg gca  tgg tgc gct ggc atc  act gac gag        7209
Val Ser  Ala Ser Glu Pro Ala  Trp Cys Ala Gly Ile  Thr Asp Glu
    2390                 2395                 2400

aag gct  gtg caa aag gct gct  acc cag gag ctc aag  cgc gcc ttt        7254
Lys Ala  Val Gln Lys Ala Ala  Thr Gln Glu Leu Lys  Arg Ala Phe
    2405                 2410                 2415

agc gct  ggc gag ggc ccc aag  ccc acg ccc cgc gct  gtc act aag        7299
Ser Ala  Gly Glu Gly Pro Lys  Pro Thr Pro Arg Ala  Val Thr Lys
    2420                 2425                 2430

ctt gtg  ggc tct gtt ctt ggc  gct cgc gag gtg cgc  agc tct att        7344
Leu Val  Gly Ser Val Leu Gly  Ala Arg Glu Val Arg  Ser Ser Ile
    2435                 2440                 2445

gct gcg  att gaa gcg ctc ggc  ggc aag gcc atc tac  tcg tcg tgc        7389
Ala Ala  Ile Glu Ala Leu Gly  Gly Lys Ala Ile Tyr  Ser Ser Cys
    2450                 2455                 2460

gac gtg  aac tct gcc gcc gac  gtg gcc aag gcc gtg  cgc gat gcc        7434
Asp Val  Asn Ser Ala Ala Asp  Val Ala Lys Ala Val  Arg Asp Ala
    2465                 2470                 2475

gag tcc  cag ctc ggt gcc cgc  gtc tcg ggc atc gtt  cat gcc tcg        7479
Glu Ser  Gln Leu Gly Ala Arg  Val Ser Gly Ile Val  His Ala Ser
    2480                 2485                 2490
```

10

```
ggc gtg ctc cgc gac cgt ctc  atc gag aag aag ctc  ccc gac gag       7524
Gly Val Leu Arg Asp Arg Leu  Ile Glu Lys Lys Leu  Pro Asp Glu
    2495            2500               2505

ttc gac gcc gtc ttt ggc acc  aag gtc acc ggt ctc  gag aac ctc       7569
Phe Asp Ala Val Phe Gly Thr  Lys Val Thr Gly Leu  Glu Asn Leu
    2510            2515               2520

ctc gcc gcc gtc gac cgc gcc  aac ctc aag cac atg  gtc ctc ttc       7614
Leu Ala Ala Val Asp Arg Ala  Asn Leu Lys His Met  Val Leu Phe
    2525            2530               2535

agc tcg ctc gcc ggc ttc cac  ggc aac gtc ggc cag  tct gac tac       7659
Ser Ser Leu Ala Gly Phe His  Gly Asn Val Gly Gln  Ser Asp Tyr
    2540            2545               2550

gcc atg gcc aac gag gcc ctt  aac aag atg ggc ctc  gag ctc gcc       7704
Ala Met Ala Asn Glu Ala Leu  Asn Lys Met Gly Leu  Glu Leu Ala
    2555            2560               2565

aag gac gtc tcg gtc aag tcg  atc tgc ttc ggt ccc  tgg gac ggt       7749
Lys Asp Val Ser Val Lys Ser  Ile Cys Phe Gly Pro  Trp Asp Gly
    2570            2575               2580

ggc atg gtg acg ccg cag ctc  aag aag cag ttc cag  gag atg ggc       7794
Gly Met Val Thr Pro Gln Leu  Lys Lys Gln Phe Gln  Glu Met Gly
    2585            2590               2595

gtg cag atc atc ccc cgc gag  ggc ggc gct gat acc  gtg gcg cgc       7839
Val Gln Ile Ile Pro Arg Glu  Gly Gly Ala Asp Thr  Val Ala Arg
    2600            2605               2610

atc gtg ctc ggc tcc tcg ccg  gct gag atc ctt gtc  ggc aac tgg       7884
Ile Val Leu Gly Ser Ser Pro  Ala Glu Ile Leu Val  Gly Asn Trp
    2615            2620               2625

cgc acc ccg tcc aag aag gtc  ggc tcg gac acc atc  acc ctg cac       7929
Arg Thr Pro Ser Lys Lys Val  Gly Ser Asp Thr Ile  Thr Leu His
    2630            2635               2640

cgc aag att tcc gcc aag tcc  aac ccc ttc ctc gag  gac cac gtc       7974
Arg Lys Ile Ser Ala Lys Ser  Asn Pro Phe Leu Glu  Asp His Val
    2645            2650               2655

atc cag ggc cgc cgc gtg ctg  ccc atg acg ctg gcc  att ggc tcg       8019
Ile Gln Gly Arg Arg Val Leu  Pro Met Thr Leu Ala  Ile Gly Ser
    2660            2665               2670

ctc gcg gag acc tgc ctc ggc  ctc ttc ccc ggc tac  tcg ctc tgg       8064
Leu Ala Glu Thr Cys Leu Gly  Leu Phe Pro Gly Tyr  Ser Leu Trp
    2675            2680               2685

gcc att gac gac gcc cag ctc  ttc aag ggt gtc act  gtc gac ggc       8109
Ala Ile Asp Asp Ala Gln Leu  Phe Lys Gly Val Thr  Val Asp Gly
    2690            2695               2700

gac gtc aac tgc gag gtg acc  ctc acc ccg tcg acg  gcg ccc tcg       8154
Asp Val Asn Cys Glu Val Thr  Leu Thr Pro Ser Thr  Ala Pro Ser
    2705            2710               2715

ggc cgc gtc aac gtc cag gcc  acg ctc aag acc ttt  tcc agc ggc       8199
Gly Arg Val Asn Val Gln Ala  Thr Leu Lys Thr Phe  Ser Ser Gly
    2720            2725               2730

aag ctg gtc ccg gcc tac cgc  gcc gtc atc gtg ctc  tcc aac cag       8244
Lys Leu Val Pro Ala Tyr Arg  Ala Val Ile Val Leu  Ser Asn Gln
    2735            2740               2745
```

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```
ggc gcg  ccc ccg gcc aac gcc  acc atg cag ccg ccc  tcg ctc gat        8289
Gly Ala  Pro Pro Ala Asn Ala  Thr Met Gln Pro Pro  Ser Leu Asp
    2750                  2755                  2760

gcc gat  ccg gcg ctc cag ggc  tcc gtc tac gac ggc  aag acc ctc        8334
Ala Asp  Pro Ala Leu Gln Gly  Ser Val Tyr Asp Gly  Lys Thr Leu
    2765                  2770                  2775

ttc cac  ggc ccg gcc ttc cgc  ggc atc gat gac gtg  ctc tcg tgc        8379
Phe His  Gly Pro Ala Phe Arg  Gly Ile Asp Asp Val  Leu Ser Cys
    2780                  2785                  2790

acc aag  agc cag ctt gtg gcc  aag tgc agc gct gtc  ccc ggc tcc        8424
Thr Lys  Ser Gln Leu Val Ala  Lys Cys Ser Ala Val  Pro Gly Ser
    2795                  2800                  2805

gac gcc  gct cgc ggc gag ttt  gcc acg gac act gac  gcc cat gac        8469
Asp Ala  Ala Arg Gly Glu Phe  Ala Thr Asp Thr Asp  Ala His Asp
    2810                  2815                  2820

ccc ttc  gtg aac gac ctg gcc  ttt cag gcc atg ctc  gtc tgg gtg        8514
Pro Phe  Val Asn Asp Leu Ala  Phe Gln Ala Met Leu  Val Trp Val
    2825                  2830                  2835

cgc cgc  acg ctc ggc cag gct  gcg ctc ccc aac tcg  atc cag cgc        8559
Arg Arg  Thr Leu Gly Gln Ala  Ala Leu Pro Asn Ser  Ile Gln Arg
    2840                  2845                  2850

atc gtc  cag cac cgc ccg gtc  ccg cag gac aag ccc  ttc tac att        8604
Ile Val  Gln His Arg Pro Val  Pro Gln Asp Lys Pro  Phe Tyr Ile
    2855                  2860                  2865

acc ctc  cgc tcc aac cag tcg  ggc ggt cac tcc cag  cac aag cac        8649
Thr Leu  Arg Ser Asn Gln Ser  Gly Gly His Ser Gln  His Lys His
    2870                  2875                  2880

gcc ctt  cag ttc cac aac gag  cag ggc gat ctc ttc  att gat gtc        8694
Ala Leu  Gln Phe His Asn Glu  Gln Gly Asp Leu Phe  Ile Asp Val
    2885                  2890                  2895

cag gct  tcg gtc atc gcc acg  gac agc ctt gcc ttc                     8730
Gln Ala  Ser Val Ile Ala Thr  Asp Ser Leu Ala Phe
    2900                  2905                  2910


<210>  2
<211>  2910
<212>  PRT
<213>  Schizochytrium sp.

<400>  2

Met Ala Ala Arg Leu Gln Glu Gln Lys Gly Gly Glu Met Asp Thr Arg
1               5                   10                  15


Ile Ala Ile Ile Gly Met Ser Ala Ile Leu Pro Cys Gly Thr Thr Val
            20                  25                  30


Arg Glu Ser Trp Glu Thr Ile Arg Ala Gly Ile Asp Cys Leu Ser Asp
            35                  40                  45


Leu Pro Glu Asp Arg Val Asp Val Thr Ala Tyr Phe Asp Pro Val Lys
    50                  55                  60
```

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```
Thr Thr Lys Asp Lys Ile Tyr Cys Lys Arg Gly Gly Phe Ile Pro Glu
65            70              75            80

Tyr Asp Phe Asp Ala Arg Glu Phe Gly Leu Asn Met Phe Gln Met Glu
              85              90            95

Asp Ser Asp Ala Asn Gln Thr Ile Ser Leu Leu Lys Val Lys Glu Ala
        100             105            110

Leu Gln Asp Ala Gly Ile Asp Ala Leu Gly Lys Glu Lys Lys Asn Ile
        115             120             125

Gly Cys Val Leu Gly Ile Gly Gly Gln Lys Ser Ser His Glu Phe
    130             135             140

Tyr Ser Arg Leu Asn Tyr Val Val Val Glu Lys Val Leu Arg Lys Met
145             150             155             160

Gly Met Pro Glu Glu Asp Val Lys Val Ala Val Glu Lys Tyr Lys Ala
            165             170             175

Asn Phe Pro Glu Trp Arg Leu Asp Ser Phe Pro Gly Phe Leu Gly Asn
        180             185             190

Val Thr Ala Gly Arg Cys Thr Asn Thr Phe Asn Leu Asp Gly Met Asn
        195             200             205

Cys Val Val Asp Ala Ala Cys Ala Ser Ser Leu Ile Ala Val Lys Val
    210             215             220

Ala Ile Asp Glu Leu Leu Tyr Gly Asp Cys Asp Met Met Val Thr Gly
225             230             235             240

Ala Thr Cys Thr Asp Asn Ser Ile Gly Met Tyr Met Ala Phe Ser Lys
            245             250             255

Thr Pro Val Phe Ser Thr Asp Pro Ser Val Arg Ala Tyr Asp Glu Lys
            260             265             270

Thr Lys Gly Met Leu Ile Gly Glu Gly Ser Ala Met Leu Val Leu Lys
        275             280             285

Arg Tyr Ala Asp Ala Val Arg Asp Gly Asp Glu Ile His Ala Val Ile
    290             295             300

Arg Gly Cys Ala Ser Ser Ser Asp Gly Lys Ala Ala Gly Ile Tyr Thr
305             310             315             320

Pro Thr Ile Ser Gly Gln Glu Glu Ala Leu Arg Arg Ala Tyr Asn Arg
            325             330             335
```

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```
Ala Cys Val Asp Pro Ala Thr Val Thr Leu Val Glu Gly His Gly Thr
        340                 345                 350

Gly Thr Pro Val Gly Asp Arg Ile Glu Leu Thr Ala Leu Arg Asn Leu
        355                 360                 365

Phe Asp Lys Ala Tyr Gly Glu Gly Asn Thr Glu Lys Val Ala Val Gly
    370                 375                 380

Ser Ile Lys Ser Ser Ile Gly His Leu Lys Ala Val Ala Gly Leu Ala
385                 390                 395                 400

Gly Met Ile Lys Val Ile Met Ala Leu Lys His Lys Thr Leu Pro Gly
                405                 410                 415

Thr Ile Asn Val Asp Asn Pro Pro Asn Leu Tyr Asp Asn Thr Pro Ile
            420                 425                 430

Asn Glu Ser Ser Leu Tyr Ile Asn Thr Met Asn Arg Pro Trp Phe Pro
        435                 440                 445

Pro Pro Gly Val Pro Arg Arg Ala Gly Ile Ser Ser Phe Gly Phe Gly
    450                 455                 460

Gly Ala Asn Tyr His Ala Val Leu Glu Glu Ala Glu Pro Glu His Thr
465                 470                 475                 480

Thr Ala Tyr Arg Leu Asn Lys Arg Pro Gln Pro Val Leu Met Met Ala
            485                 490                 495

Ala Thr Pro Ala Ala Leu Gln Ser Leu Cys Glu Ala Gln Leu Lys Glu
            500                 505                 510

Phe Glu Ala Ala Ile Lys Glu Asn Glu Thr Val Lys Asn Thr Ala Tyr
        515                 520                 525

Ile Lys Cys Val Lys Phe Gly Glu Gln Phe Lys Phe Pro Gly Ser Ile
    530                 535                 540

Pro Ala Thr Asn Ala Arg Leu Gly Phe Leu Val Lys Asp Ala Glu Asp
545                 550                 555                 560

Ala Cys Ser Thr Leu Arg Ala Ile Cys Ala Gln Phe Ala Lys Asp Val
            565                 570                 575

Thr Lys Glu Ala Trp Arg Leu Pro Arg Glu Gly Val Ser Phe Arg Ala
        580                 585                 590

Lys Gly Ile Ala Thr Asn Gly Ala Val Ala Ala Leu Phe Ser Gly Gln
        595                 600                 605
```

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```
Gly Ala Gln Tyr Thr His Met Phe Ser Glu Val Ala Met Asn Trp Pro
    610             615             620

Gln Phe Arg Gln Ser Ile Ala Ala Met Asp Ala Ala Gln Ser Lys Val
625             630             635             640

Ala Gly Ser Asp Lys Asp Phe Glu Arg Val Ser Gln Val Leu Tyr Pro
            645             650             655

Arg Lys Pro Tyr Glu Arg Glu Pro Glu Gln Asn Pro Lys Lys Ile Ser
        660             665             670

Leu Thr Ala Tyr Ser Gln Pro Ser Thr Leu Ala Cys Ala Leu Gly Ala
    675             680             685

Phe Glu Ile Phe Lys Glu Ala Gly Phe Thr Pro Asp Phe Ala Ala Gly
    690             695             700

His Ser Leu Gly Glu Phe Ala Ala Leu Tyr Ala Ala Gly Cys Val Asp
705             710             715             720

Arg Asp Glu Leu Phe Glu Leu Val Cys Arg Arg Ala Arg Ile Met Gly
            725             730             735

Gly Lys Asp Ala Pro Ala Thr Pro Lys Gly Cys Met Ala Ala Val Ile
        740             745             750

Gly Pro Asn Ala Glu Asn Ile Lys Val Gln Ala Ala Asn Val Trp Leu
        755             760             765

Gly Asn Ser Asn Ser Pro Ser Gln Thr Val Ile Thr Gly Ser Val Glu
    770             775             780

Gly Ile Gln Ala Glu Ser Ala Arg Leu Gln Lys Glu Gly Phe Arg Val
785             790             795             800

Val Pro Leu Ala Cys Glu Ser Ala Phe His Ser Pro Gln Met Glu Asn
            805             810             815

Ala Ser Ser Ala Phe Lys Asp Val Ile Ser Lys Val Ser Phe Arg Thr
        820             825             830

Pro Lys Ala Glu Thr Lys Leu Phe Ser Asn Val Ser Gly Glu Thr Tyr
        835             840             845

Pro Thr Asp Ala Arg Glu Met Leu Thr Gln His Met Thr Ser Ser Val
    850             855             860

Lys Phe Leu Thr Gln Val Arg Asn Met His Gln Ala Gly Ala Arg Ile
865             870             875             880
```

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Phe Val Glu Phe Gly Pro Lys Gln Val Leu Ser Lys Leu Val Ser Glu
                885   890   895

Thr Leu Lys Asp Asp Pro Ser Val Val Thr Val Ser Val Asn Pro Ala
            900   905   910

Ser Gly Thr Asp Ser Asp Ile Gln Leu Arg Asp Ala Ala Val Gln Leu
        915   920   925

Val Val Ala Gly Val Asn Leu Gln Gly Phe Asp Lys Trp Asp Ala Pro
    930   935   940

Asp Ala Thr Arg Met Gln Ala Ile Lys Lys Lys Arg Thr Thr Leu Arg
945   950   955   960

Leu Ser Ala Ala Thr Tyr Val Ser Asp Lys Thr Lys Lys Val Arg Asp
            965   970   975

Ala Ala Met Asn Asp Gly Arg Cys Val Thr Tyr Leu Lys Gly Ala Ala
        980   985   990

Pro Leu Ile Lys Ala Pro Glu Pro Val Val Asp Glu Ala Ala Lys Arg
    995   1000   1005

Glu Ala Glu Arg Leu Gln Lys Glu Leu Gln Asp Ala Gln Arg Gln
    1010   1015   1020

Leu Asp Asp Ala Lys Arg Ala Ala Ala Glu Ala Asn Ser Lys Leu
    1025   1030   1035

Ala Ala Ala Lys Glu Glu Ala Lys Thr Ala Ala Ala Ser Ala Lys
    1040   1045   1050

Pro Ala Val Asp Thr Ala Val Val Glu Lys His Arg Ala Ile Leu
    1055   1060   1065

Lys Ser Met Leu Ala Glu Leu Asp Gly Tyr Gly Ser Val Asp Ala
    1070   1075   1080

Ser Ser Leu Gln Gln Gln Gln Gln Gln Gln Thr Ala Pro Ala Pro
    1085   1090   1095

Val Lys Ala Ala Ala Pro Ala Ala Pro Val Ala Ser Ala Pro Ala
    1100   1105   1110

Pro Ala Val Ser Asn Glu Leu Leu Glu Lys Ala Glu Thr Val Val
    1115   1120   1125

Met Glu Val Leu Ala Ala Lys Thr Gly Tyr Glu Thr Asp Met Ile
    1130   1135   1140

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```
Glu Ala  Asp Met Glu Leu Glu  Thr Glu Leu Gly Ile  Asp Ser Ile
    1145                 1150                 1155

Lys Arg  Val Glu Ile Leu Ser  Glu Val Gln Ala Met  Leu Asn Val
    1160                 1165                 1170

Glu Ala  Lys Asp Val Asp Ala  Leu Ser Arg Thr Arg  Thr Val Gly
    1175                 1180                 1185

Glu Val  Val Asn Ala Met Lys  Ala Glu Ile Ala Gly  Ser Ser Ala
    1190                 1195                 1200

Pro Ala  Pro Ala Ala Ala Ala  Pro Ala Pro Ala Lys  Ala Ala Pro
    1205                 1210                 1215

Ala Ala  Ala Ala Pro Ala Val  Ser Asn Glu Leu Leu  Glu Lys Ala
    1220                 1225                 1230

Glu Thr  Val Val Met Glu Val  Leu Ala Ala Lys Thr  Gly Tyr Glu
    1235                 1240                 1245

Thr Asp  Met Ile Glu Ser Asp  Met Glu Leu Glu Thr  Glu Leu Gly
    1250                 1255                 1260

Ile Asp  Ser Ile Lys Arg Val  Glu Ile Leu Ser Glu  Val Gln Ala
    1265                 1270                 1275

Met Leu  Asn Val Glu Ala Lys  Asp Val Asp Ala Leu  Ser Arg Thr
    1280                 1285                 1290

Arg Thr  Val Gly Glu Val Val  Asn Ala Met Lys Ala  Glu Ile Ala
    1295                 1300                 1305

Gly Gly  Ser Ala Pro Ala Pro  Ala Ala Ala Ala Pro  Gly Pro Ala
    1310                 1315                 1320

Ala Ala  Ala Pro Ala Pro Ala  Ala Ala Ala Pro Ala  Val Ser Asn
    1325                 1330                 1335

Glu Leu  Leu Glu Lys Ala Glu  Thr Val Val Met Glu  Val Leu Ala
    1340                 1345                 1350

Ala Lys  Thr Gly Tyr Glu Thr  Asp Met Ile Glu Ser  Asp Met Glu
    1355                 1360                 1365

Leu Glu  Thr Glu Leu Gly Ile  Asp Ser Ile Lys Arg  Val Glu Ile
    1370                 1375                 1380

Leu Ser  Glu Val Gln Ala Met  Leu Asn Val Glu Ala  Lys Asp Val
    1385                 1390                 1395
```

Asp Ala Leu Ser Arg Thr Arg Thr Val Gly Glu Val Val Asp Ala
    1400   1405   1410

Met Lys Ala Glu Ile Ala Gly Gly Ser Ala Pro Ala Pro Ala Ala
    1415   1420   1425

Ala Ala Pro Ala Pro Ala Ala Ala Ala Pro Ala Pro Ala Ala Pro
    1430   1435   1440

Ala Pro Ala Val Ser Ser Glu Leu Leu Glu Lys Ala Glu Thr Val
    1445   1450   1455

Val Met Glu Val Leu Ala Ala Lys Thr Gly Tyr Glu Thr Asp Met
    1460   1465   1470

Ile Glu Ser Asp Met Glu Leu Glu Thr Glu Leu Gly Ile Asp Ser
    1475   1480   1485

Ile Lys Arg Val Glu Ile Leu Ser Glu Val Gln Ala Met Leu Asn
    1490   1495   1500

Val Glu Ala Lys Asp Val Asp Ala Leu Ser Arg Thr Arg Thr Val
    1505   1510   1515

Gly Glu Val Val Asp Ala Met Lys Ala Glu Ile Ala Gly Gly Ser
    1520   1525   1530

Ala Pro Ala Pro Ala Ala Ala Ala Pro Ala Pro Ala Ala Ala Ala
    1535   1540   1545

Pro Ala Pro Ala Ala Pro Ala Pro Ala Ala Pro Ala Pro Ala Val
    1550   1555   1560

Ser Ser Glu Leu Leu Glu Lys Ala Glu Thr Val Val Met Glu Val
    1565   1570   1575

Leu Ala Ala Lys Thr Gly Tyr Glu Thr Asp Met Ile Glu Ser Asp
    1580   1585   1590

Met Glu Leu Glu Thr Glu Leu Gly Ile Asp Ser Ile Lys Arg Val
    1595   1600   1605

Glu Ile Leu Ser Glu Val Gln Ala Met Leu Asn Val Glu Ala Lys
    1610   1615   1620

Asp Val Asp Ala Leu Ser Arg Thr Arg Thr Val Gly Glu Val Val
    1625   1630   1635

Asp Ala Met Lys Ala Glu Ile Ala Gly Ser Ser Ala Ser Ala Pro
    1640   1645   1650

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```
Ala Ala  Ala Ala Pro Ala Pro  Ala Ala Ala Ala Pro  Ala Pro Ala
    1655             1660               1665

Ala Ala  Ala Pro Ala Val Ser  Asn Glu Leu Leu Glu  Lys Ala Glu
    1670             1675               1680

Thr Val  Val Met Glu Val Leu  Ala Ala Lys Thr Gly  Tyr Glu Thr
    1685             1690               1695

Asp Met  Ile Glu Ser Asp Met  Glu Leu Glu Thr Glu  Leu Gly Ile
    1700             1705               1710

Asp Ser  Ile Lys Arg Val Glu  Ile Leu Ser Glu Val  Gln Ala Met
    1715             1720               1725

Leu Asn  Val Glu Ala Lys Asp  Val Asp Ala Leu Ser  Arg Thr Arg
    1730             1735               1740

Thr Val  Gly Glu Val Val Asp  Ala Met Lys Ala Glu  Ile Ala Gly
    1745             1750               1755

Gly Ser  Ala Pro Ala Pro Ala  Ala Ala Ala Pro Ala  Pro Ala Ala
    1760             1765               1770

Ala Ala  Pro Ala Val Ser Asn  Glu Leu Leu Glu Lys  Ala Glu Thr
    1775             1780               1785

Val Val  Met Glu Val Leu Ala  Ala Lys Thr Gly Tyr  Glu Thr Asp
    1790             1795               1800

Met Ile  Glu Ser Asp Met Glu  Leu Glu Thr Glu Leu  Gly Ile Asp
    1805             1810               1815

Ser Ile  Lys Arg Val Glu Ile  Leu Ser Glu Val Gln  Ala Met Leu
    1820             1825               1830

Asn Val  Glu Ala Lys Asp Val  Asp Ala Leu Ser Arg  Thr Arg Thr
    1835             1840               1845

Val Gly  Glu Val Val Asp Ala  Met Lys Ala Glu Ile  Ala Gly Ser
    1850             1855               1860

Ser Ala  Pro Ala Pro Ala Ala  Ala Ala Pro Ala Pro  Ala Ala Ala
    1865             1870               1875

Ala Pro  Ala Pro Ala Ala Ala  Ala Pro Ala Val Ser  Ser Glu Leu
    1880             1885               1890

Leu Glu  Lys Ala Glu Thr Val  Val Met Glu Val Leu  Ala Ala Lys
    1895             1900               1905
```

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Thr Gly  Tyr Glu Thr Asp Met  Ile Glu Ser Asp Met  Glu Leu Glu
    1910                 1915              1920

Thr Glu  Leu Gly Ile Asp Ser  Ile Lys Arg Val Glu  Ile Leu Ser
    1925                 1930              1935

Glu Val  Gln Ala Met Leu Asn  Val Glu Ala Lys Asp  Val Asp Ala
    1940                 1945              1950

Leu Ser  Arg Thr Arg Thr Val  Gly Glu Val Val Asp  Ala Met Lys
    1955                 1960              1965

Ala Glu  Ile Ala Gly Gly Ser  Ala Pro Ala Pro Ala  Ala Ala Ala
    1970                 1975              1980

Pro Ala  Pro Ala Ala Ala Ala  Pro Ala Val Ser Asn  Glu Leu Leu
    1985                 1990              1995

Glu Lys  Ala Glu Thr Val Val  Met Glu Val Leu Ala  Ala Lys Thr
    2000                 2005              2010

Gly Tyr  Glu Thr Asp Met Ile  Glu Ser Asp Met Glu  Leu Glu Thr
    2015                 2020              2025

Glu Leu  Gly Ile Asp Ser Ile  Lys Arg Val Glu Ile  Leu Ser Glu
    2030                 2035              2040

Val Gln  Ala Met Leu Asn Val  Glu Ala Lys Asp Val  Asp Ala Leu
    2045                 2050              2055

Ser Arg  Thr Arg Thr Val Gly  Glu Val Val Asp Ala  Met Lys Ala
    2060                 2065              2070

Glu Ile  Ala Gly Gly Ser Ala  Pro Ala Pro Ala Ala  Ala Ala Pro
    2075                 2080              2085

Ala Ser  Ala Gly Ala Ala Pro  Ala Val Lys Ile Asp  Ser Val His
    2090                 2095              2100

Gly Ala  Asp Cys Asp Asp Leu  Ser Leu Met His Ala  Lys Val Val
    2105                 2110              2115

Asp Ile  Arg Arg Pro Asp Glu  Leu Ile Leu Glu Arg  Pro Glu Asn
    2120                 2125              2130

Arg Pro  Val Leu Val Val Asp  Asp Gly Ser Glu Leu  Thr Leu Ala
    2135                 2140              2145

Leu Val  Arg Val Leu Gly Ala  Cys Ala Val Val Leu  Thr Phe Glu
    2150                 2155              2160
```

20

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Gly Leu  Gln Leu Ala Gln Arg  Ala Gly Ala Ala Ala  Ile Arg His
    2165              2170              2175

Val Leu  Ala Lys Asp Leu Ser  Ala Glu Ser Ala Glu  Lys Ala Ile
    2180              2185              2190

Lys Glu  Ala Glu Gln Arg Phe  Gly Ala Leu Gly Gly  Phe Ile Ser
    2195              2200              2205

Gln Gln  Ala Glu Arg Phe Glu  Pro Ala Glu Ile Leu  Gly Phe Thr
    2210              2215              2220

Leu Met  Cys Ala Lys Phe Ala  Lys Ala Ser Leu Cys  Thr Ala Val
    2225              2230              2235

Ala Gly  Gly Arg Pro Ala Phe  Ile Gly Val Ala Arg  Leu Asp Gly
    2240              2245              2250

Arg Leu  Gly Phe Thr Ser Gln  Gly Thr Ser Asp Ala  Leu Lys Arg
    2255              2260              2265

Ala Gln  Arg Gly Ala Ile Phe  Gly Leu Cys Lys Thr  Ile Gly Leu
    2270              2275              2280

Glu Trp  Ser Glu Ser Asp Val  Phe Ser Arg Gly Val  Asp Ile Ala
    2285              2290              2295

Gln Gly  Met His Pro Glu Asp  Ala Ala Val Ala Ile  Val Arg Glu
    2300              2305              2310

Met Ala  Cys Ala Asp Ile Arg  Ile Arg Glu Val Gly  Ile Gly Ala
    2315              2320              2325

Asn Gln  Gln Arg Cys Thr Ile  Arg Ala Ala Lys Leu  Glu Thr Gly
    2330              2335              2340

Asn Pro  Gln Arg Gln Ile Ala  Lys Asp Asp Val Leu  Leu Val Ser
    2345              2350              2355

Gly Gly  Ala Arg Gly Ile Thr  Pro Leu Cys Ile Arg  Glu Ile Thr
    2360              2365              2370

Arg Gln  Ile Ala Gly Gly Lys  Tyr Ile Leu Leu Gly  Arg Ser Lys
    2375              2380              2385

Val Ser  Ala Ser Glu Pro Ala  Trp Cys Ala Gly Ile  Thr Asp Glu
    2390              2395              2400

Lys Ala  Val Gln Lys Ala Ala  Thr Gln Glu Leu Lys  Arg Ala Phe
    2405              2410              2415
```

21

```
Ser Ala  Gly Glu Gly Pro Lys  Pro Thr Pro Arg Ala   Val Thr Lys
    2420              2425              2430

Leu Val  Gly Ser Val Leu Gly  Ala Arg Glu Val Arg   Ser Ser Ile
    2435              2440              2445

Ala Ala  Ile Glu Ala Leu Gly  Gly Lys Ala Ile Tyr   Ser Ser Cys
    2450              2455              2460

Asp Val  Asn Ser Ala Ala Asp  Val Ala Lys Ala Val   Arg Asp Ala
    2465              2470              2475

Glu Ser  Gln Leu Gly Ala Arg  Val Ser Gly Ile Val   His Ala Ser
    2480              2485              2490

Gly Val  Leu Arg Asp Arg Leu  Ile Glu Lys Lys Leu   Pro Asp Glu
    2495              2500              2505

Phe Asp  Ala Val Phe Gly Thr  Lys Val Thr Gly Leu   Glu Asn Leu
    2510              2515              2520

Leu Ala  Ala Val Asp Arg Ala  Asn Leu Lys His Met   Val Leu Phe
    2525              2530              2535

Ser Ser  Leu Ala Gly Phe His  Gly Asn Val Gly Gln   Ser Asp Tyr
    2540              2545              2550

Ala Met  Ala Asn Glu Ala Leu  Asn Lys Met Gly Leu   Glu Leu Ala
    2555              2560              2565

Lys Asp  Val Ser Val Lys Ser  Ile Cys Phe Gly Pro   Trp Asp Gly
    2570              2575              2580

Gly Met  Val Thr Pro Gln Leu  Lys Lys Gln Phe Gln   Glu Met Gly
    2585              2590              2595

Val Gln  Ile Ile Pro Arg Glu  Gly Gly Ala Asp Thr   Val Ala Arg
    2600              2605              2610

Ile Val  Leu Gly Ser Ser Pro  Ala Glu Ile Leu Val   Gly Asn Trp
    2615              2620              2625

Arg Thr  Pro Ser Lys Lys Val  Gly Ser Asp Thr Ile   Thr Leu His
    2630              2635              2640

Arg Lys  Ile Ser Ala Lys Ser  Asn Pro Phe Leu Glu   Asp His Val
    2645              2650              2655

Ile Gln  Gly Arg Arg Val Leu  Pro Met Thr Leu Ala   Ile Gly Ser
    2660              2665              2670
```

22

```
Leu Ala  Glu Thr Cys Leu Gly  Leu Phe Pro Gly Tyr  Ser Leu Trp
    2675             2680             2685

Ala Ile  Asp Asp Ala Gln Leu  Phe Lys Gly Val Thr  Val Asp Gly
    2690             2695             2700

Asp Val  Asn Cys Glu Val Thr  Leu Thr Pro Ser Thr  Ala Pro Ser
    2705             2710             2715

Gly Arg  Val Asn Val Gln Ala  Thr Leu Lys Thr Phe  Ser Ser Gly
    2720             2725             2730

Lys Leu  Val Pro Ala Tyr Arg  Ala Val Ile Val Leu  Ser Asn Gln
    2735             2740             2745

Gly Ala  Pro Pro Ala Asn Ala  Thr Met Gln Pro Pro  Ser Leu Asp
    2750             2755             2760

Ala Asp  Pro Ala Leu Gln Gly  Ser Val Tyr Asp Gly  Lys Thr Leu
    2765             2770             2775

Phe His  Gly Pro Ala Phe Arg  Gly Ile Asp Asp Val  Leu Ser Cys
    2780             2785             2790

Thr Lys  Ser Gln Leu Val Ala  Lys Cys Ser Ala Val  Pro Gly Ser
    2795             2800             2805

Asp Ala  Ala Arg Gly Glu Phe  Ala Thr Asp Thr Asp  Ala His Asp
    2810             2815             2820

Pro Phe  Val Asn Asp Leu Ala  Phe Gln Ala Met Leu  Val Trp Val
    2825             2830             2835

Arg Arg  Thr Leu Gly Gln Ala  Ala Leu Pro Asn Ser  Ile Gln Arg
    2840             2845             2850

Ile Val  Gln His Arg Pro Val  Pro Gln Asp Lys Pro  Phe Tyr Ile
    2855             2860             2865

Thr Leu  Arg Ser Asn Gln Ser  Gly Gly His Ser Gln  His Lys His
    2870             2875             2880

Ala Leu  Gln Phe His Asn Glu  Gln Gly Asp Leu Phe  Ile Asp Val
    2885             2890             2895

Gln Ala  Ser Val Ile Ala Thr  Asp Ser Leu Ala Phe
    2900             2905             2910
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<210> 3
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<212> DNA
<213> Schizochytrium sp.

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<222>  (1)..(6177)

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Met Ala Ala Arg Asn Val Ser Ala Ala His Glu Met His Asp Glu Lys
1               5                   10                  15

cgc atc gcc gtc gtc ggc atg gcc gtc cag tac gcc gga tgc aaa acc          96
Arg Ile Ala Val Val Gly Met Ala Val Gln Tyr Ala Gly Cys Lys Thr
                20                  25                  30

aag gac gag ttc tgg gag gtg ctc atg aac ggc aag gtc gag tcc aag         144
Lys Asp Glu Phe Trp Glu Val Leu Met Asn Gly Lys Val Glu Ser Lys
            35                  40                  45

gtg atc agc gac aaa cga ctc ggc tcc aac tac cgc gcc gag cac tac         192
Val Ile Ser Asp Lys Arg Leu Gly Ser Asn Tyr Arg Ala Glu His Tyr
        50                  55                  60

aaa gca gag cgc agc aag tat gcc gac acc ttt tgc aac gaa acg tac         240
Lys Ala Glu Arg Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Thr Tyr
65                  70                  75                  80

ggc acc ctt gac gag aac gag atc gac aac gag cac gaa ctc ctc ctc         288
Gly Thr Leu Asp Glu Asn Glu Ile Asp Asn Glu His Glu Leu Leu Leu
                85                  90                  95

aac ctc gcc aag cag gca ctc gca gag aca tcc gtc aaa gac tcg aca         336
Asn Leu Ala Lys Gln Ala Leu Ala Glu Thr Ser Val Lys Asp Ser Thr
                100                 105                 110

cgc tgc ggc atc gtc agc ggc tgc ctc tcg ttc ccc atg gac aac ctc         384
Arg Cys Gly Ile Val Ser Gly Cys Leu Ser Phe Pro Met Asp Asn Leu
            115                 120                 125

cag ggt gaa ctc ctc aac gtg tac caa aac cat gtc gag aaa aag ctc         432
Gln Gly Glu Leu Leu Asn Val Tyr Gln Asn His Val Glu Lys Lys Leu
        130                 135                 140

ggg gcc cgc gtc ttc aag gac gcc tcc cat tgg tcc gaa cgc gag cag         480
Gly Ala Arg Val Phe Lys Asp Ala Ser His Trp Ser Glu Arg Glu Gln
145                 150                 155                 160

tcc aac aaa ccc gag gcc ggt gac cgc cgc atc ttc atg gac ccg gcc         528
Ser Asn Lys Pro Glu Ala Gly Asp Arg Arg Ile Phe Met Asp Pro Ala
                165                 170                 175

tcc ttc gtc gcc gaa gaa ctc aac ctc ggc gcc ctt cac tac tcc gtc         576
Ser Phe Val Ala Glu Glu Leu Asn Leu Gly Ala Leu His Tyr Ser Val
                180                 185                 190

gac gca gca tgc gcc acg gcg ctc tac gtg ctc cgc ctc gcg cag gat         624
Asp Ala Ala Cys Ala Thr Ala Leu Tyr Val Leu Arg Leu Ala Gln Asp
            195                 200                 205

cat ctc gtc tcc ggc gcc gcc gac gtc atg ctc tgc ggt gcc acc tgc         672
His Leu Val Ser Gly Ala Ala Asp Val Met Leu Cys Gly Ala Thr Cys
        210                 215                 220

ctg ccg gag ccc ttt ttc atc ctt tcg ggc ttt tcc acc ttc cag gcc         720
Leu Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe Ser Thr Phe Gln Ala
225                 230                 235                 240

atg ccc gtc ggc acg ggc cag aac gtg tcc atg ccg ctg cac aag gac         768
Met Pro Val Gly Thr Gly Gln Asn Val Ser Met Pro Leu His Lys Asp
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agc cag ggc ctc acc ccg ggt gag ggc ggc tcc atc atg gtc ctc aag        816
Ser Gln Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile Met Val Leu Lys
        260                        265                        270

cgt ctc gat gat gcc atc cgc gac ggc gac cac att tac ggc acc ctt        864
Arg Leu Asp Asp Ala Ile Arg Asp Gly Asp His Ile Tyr Gly Thr Leu
        275                        280                        285

ctc ggc gcc aat gtc agc aac tcc ggc aca ggt ctg ccc ctc aag ccc        912
Leu Gly Ala Asn Val Ser Asn Ser Gly Thr Gly Leu Pro Leu Lys Pro
        290                        295                        300

ctt ctc ccc agc gag aaa aag tgc ctc atg gac acc tac acg cgc att        960
Leu Leu Pro Ser Glu Lys Lys Cys Leu Met Asp Thr Tyr Thr Arg Ile
305                        310                        315                        320

aac gtg cac ccg cac aag att cag tac gtc gag tgc cac gcc acc ggc       1008
Asn Val His Pro His Lys Ile Gln Tyr Val Glu Cys His Ala Thr Gly
                325                        330                        335

acg ccc cag ggt gat cgt gtg gaa atc gac gcc gtc aag gcc tgc ttt       1056
Thr Pro Gln Gly Asp Arg Val Glu Ile Asp Ala Val Lys Ala Cys Phe
                340                        345                        350

gaa ggc aag gtc ccc cgt ttc ggt acc aca aag ggc aac ttt gga cac       1104
Glu Gly Lys Val Pro Arg Phe Gly Thr Thr Lys Gly Asn Phe Gly His
                355                        360                        365

acc cts gyc gca gcc ggc ttt gcc ggt atg tgc aag gtc ctc ctc tcc       1152
Thr Xaa Xaa Ala Ala Gly Phe Ala Gly Met Cys Lys Val Leu Leu Ser
        370                        375                        380

atg aag cat ggc atc atc ccg ccc acc ccg ggt atc gat gac gag acc       1200
Met Lys His Gly Ile Ile Pro Pro Thr Pro Gly Ile Asp Asp Glu Thr
385                        390                        395                        400

aag atg gac cct ctc gtc gtc tcc ggt gag gcc atc cca tgg cca gag       1248
Lys Met Asp Pro Leu Val Val Ser Gly Glu Ala Ile Pro Trp Pro Glu
                405                        410                        415

acc aac ggc gag ccc aag cgc gcc ggt ctc tcg gcc ttt ggc ttt ggt       1296
Thr Asn Gly Glu Pro Lys Arg Ala Gly Leu Ser Ala Phe Gly Phe Gly
                420                        425                        430

ggc acc aac gcc cat gcc gtc ttt gag gag cat gac ccc tcc aac gcc       1344
Gly Thr Asn Ala His Ala Val Phe Glu Glu His Asp Pro Ser Asn Ala
                435                        440                        445

gcc tgc acg ggc cac gac tcc att tct gcg ctc tcg gcc cgc tgc ggc       1392
Ala Cys Thr Gly His Asp Ser Ile Ser Ala Leu Ser Ala Arg Cys Gly
        450                        455                        460

ggt gaa agc aac atg cgc atc gcc atc act ggt atg gac gcc acc ttt       1440
Gly Glu Ser Asn Met Arg Ile Ala Ile Thr Gly Met Asp Ala Thr Phe
465                        470                        475                        480

ggc gct ctc aag gga ctc gac gcc ttc gag cgc gcc att tac acc ggc       1488
Gly Ala Leu Lys Gly Leu Asp Ala Phe Glu Arg Ala Ile Tyr Thr Gly
                485                        490                        495

gct cac ggt gcc atc cca ctc cca gaa aag cgc tgg cgc ttt ctc ggc       1536
Ala His Gly Ala Ile Pro Leu Pro Glu Lys Arg Trp Arg Phe Leu Gly
                500                        505                        510

aag gac aag gac ttt ctt gac ctc tgc ggc gtc aag gcc acc ccg cac       1584
Lys Asp Lys Asp Phe Leu Asp Leu Cys Gly Val Lys Ala Thr Pro His
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                  515                      520                      525

ggc tgc tac att gaa gat gtt gag gtc gac ttc cag cgc ctc cgc acg          1632
Gly Cys Tyr Ile Glu Asp Val Glu Val Asp Phe Gln Arg Leu Arg Thr
    530                     535                     540

ccc atg acc cct gaa gac atg ctc ctc cct cag cag ctt ctg gcc gtc          1680
Pro Met Thr Pro Glu Asp Met Leu Leu Pro Gln Gln Leu Leu Ala Val
545                     550                     555                 560

acc acc att gac cgc gcc atc ctc gac tcg gga atg aaa aag ggt ggc          1728
Thr Thr Ile Asp Arg Ala Ile Leu Asp Ser Gly Met Lys Lys Gly Gly
                565                     570                     575

aat gtc gcc gtc ttt gtc ggc ctc ggc acc gac ctc gag ctc tac cgt          1776
Asn Val Ala Val Phe Val Gly Leu Gly Thr Asp Leu Glu Leu Tyr Arg
                580                     585                     590

cac cgt gct cgc gtc gct ctc aag gag cgc gtc cgc cct gaa gcc tcc          1824
His Arg Ala Arg Val Ala Leu Lys Glu Arg Val Arg Pro Glu Ala Ser
                595                     600                     605

aag aag ctc aat gac atg atg cag tac att aac gac tgc ggc aca tcc          1872
Lys Lys Leu Asn Asp Met Met Gln Tyr Ile Asn Asp Cys Gly Thr Ser
    610                     615                     620

aca tcg tac acc tcg tac att ggc aac ctc gtc gcc acg cgc gtc tcg          1920
Thr Ser Tyr Thr Ser Tyr Ile Gly Asn Leu Val Ala Thr Arg Val Ser
625                     630                      635                640

tcg cag tgg ggc ttc acg ggc ccc tcc ttt acg atc acc gag ggc aac          1968
Ser Gln Trp Gly Phe Thr Gly Pro Ser Phe Thr Ile Thr Glu Gly Asn
                645                     650                     655

aac tcc gtc tac cgc tgc gcc gag ctc ggc aag tac ctc ctc gag acc          2016
Asn Ser Val Tyr Arg Cys Ala Glu Leu Gly Lys Tyr Leu Leu Glu Thr
                660                     665                     670

ggc gag gtc gat ggc gtc gtc gtt gcg ggt gtc gat ctc tgc ggc agt          2064
Gly Glu Val Asp Gly Val Val Val Ala Gly Val Asp Leu Cys Gly Ser
                675                     680                     685

gcc gaa aac ctt tac gtc aag tct cgc cgc ttc aag gtg tcc acc tcc          2112
Ala Glu Asn Leu Tyr Val Lys Ser Arg Arg Phe Lys Val Ser Thr Ser
    690                     695                     700

gat acc ccg cgc gcc agc ttt gac gcc gcc gcc gat ggc tac ttt gtc          2160
Asp Thr Pro Arg Ala Ser Phe Asp Ala Ala Ala Asp Gly Tyr Phe Val
705                     710                     715                 720

ggc gag ggc tgc ggt gcc ttt gtg ctc aag cgt gag act agc tgc acc          2208
Gly Glu Gly Cys Gly Ala Phe Val Leu Lys Arg Glu Thr Ser Cys Thr
                725                     730                     735

aag gac gac cgt atc tac gct tgc atg gat gcc atc gtc cct ggc aac          2256
Lys Asp Asp Arg Ile Tyr Ala Cys Met Asp Ala Ile Val Pro Gly Asn
                740                     745                     750

gtc cct agc gcc tgc ttg cgc gag gcc ctc gac cag gcg cgc gtc aag          2304
Val Pro Ser Ala Cys Leu Arg Glu Ala Leu Asp Gln Ala Arg Val Lys
                755                     760                     765

ccg ggc gat atc gag atg ctc gag ctc agc gcc gac tcc gcc cgc cac          2352
Pro Gly Asp Ile Glu Met Leu Glu Leu Ser Ala Asp Ser Ala Arg His
    770                     775                     780

ctc aag gac ccg tcc gtc ctg ccc aag gag ctc act gcc gag gag gaa          2400
Leu Lys Asp Pro Ser Val Leu Pro Lys Glu Leu Thr Ala Glu Glu Glu
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atc ggc ggc ctt cag acg atc ctt cgt gac gat gac aag ctc ccg cgc        2448
Ile Gly Gly Leu Gln Thr Ile Leu Arg Asp Asp Asp Lys Leu Pro Arg
            805                          810                          815

aac gtc gca acg ggc agt gtc aag gcc acc gtc ggt gac acc ggt tat        2496
Asn Val Ala Thr Gly Ser Val Lys Ala Thr Val Gly Asp Thr Gly Tyr
            820                          825                          830

gcc tct ggt gct gcc agc ctc atc aag gct gcg ctt tgc atc tac aac        2544
Ala Ser Gly Ala Ala Ser Leu Ile Lys Ala Ala Leu Cys Ile Tyr Asn
            835                          840                          845

cgc tac ctg ccc agc aac ggc gac gac tgg gat gaa ccc gcc cct gag        2592
Arg Tyr Leu Pro Ser Asn Gly Asp Asp Trp Asp Glu Pro Ala Pro Glu
            850                          855                          860

gcg ccc tgg gac agc acc ctc ttt gcg tgc cag acc tcg cgc gct tgg        2640
Ala Pro Trp Asp Ser Thr Leu Phe Ala Cys Gln Thr Ser Arg Ala Trp
865                          870                          875                          880

ctc aag aac cct ggc gag cgt cgc tat gcg gcc gtc tcg ggc gtc tcc        2688
Leu Lys Asn Pro Gly Glu Arg Arg Tyr Ala Ala Val Ser Gly Val Ser
            885                          890                          895

gag acg cgc tcg tgc tat tcc gtg ctc ctc tcc gaa gcc gag ggc cac        2736
Glu Thr Arg Ser Cys Tyr Ser Val Leu Leu Ser Glu Ala Glu Gly His
            900                          905                          910

tac gag cgc gag aac cgc atc tcg ctc gac gag gag gcg ccc aag ctc        2784
Tyr Glu Arg Glu Asn Arg Ile Ser Leu Asp Glu Glu Ala Pro Lys Leu
            915                          920                          925

att gtg ctt cgc gcc gac tcc cac gag gag atc ctt ggt cgc ctc gac        2832
Ile Val Leu Arg Ala Asp Ser His Glu Glu Ile Leu Gly Arg Leu Asp
            930                          935                          940

aag atc cgc gag cgc ttc ttg cag ccc acg ggc gcc gcc ccg cgc gag        2880
Lys Ile Arg Glu Arg Phe Leu Gln Pro Thr Gly Ala Ala Pro Arg Glu
945                          950                          955                          960

tcc gag ctc aag gcg cag gcc cgc cgc atc ttc ctc gag ctc ctc ggc        2928
Ser Glu Leu Lys Ala Gln Ala Arg Arg Ile Phe Leu Glu Leu Leu Gly
            965                          970                          975

gag acc ctt gcc cag gat gcc gct tct tca ggc tcg caa aag ccc ctc        2976
Glu Thr Leu Ala Gln Asp Ala Ala Ser Ser Gly Ser Gln Lys Pro Leu
            980                          985                          990

gct ctc agc ctc gtc tcc acg ccc  tcc aag ctc cag cgc  gag gtc gag      3024
Ala Leu Ser Leu Val Ser Thr Pro  Ser Lys Leu Gln Arg  Glu Val Glu
            995                          1000                         1005

ctc gcg  gcc aag ggt atc ccg  cgc tgc ctc aag atg  cgc cgc gat        3069
Leu Ala  Ala Lys Gly Ile Pro  Arg Cys Leu Lys Met  Arg Arg Asp
    1010                         1015                         1020

tgg agc  tcc cct gct ggc agc  cgc tac gcg cct gag  ccg ctc gcc        3114
Trp Ser  Ser Pro Ala Gly Ser  Arg Tyr Ala Pro Glu  Pro Leu Ala
    1025                         1030                         1035

agc gac  cgc gtc gcc ttc atg  tac ggc gaa ggt cgc  agc cct tac        3159
Ser Asp  Arg Val Ala Phe Met  Tyr Gly Glu Gly Arg  Ser Pro Tyr
    1040                         1045                         1050

tac ggc  atc acc caa gac att  cac cgc att tgg ccc  gaa ctc cac        3204
Tyr Gly  Ile Thr Gln Asp Ile  His Arg Ile Trp Pro  Glu Leu His
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gag gtc atc aac gaa aag acg  aac cgt ctc tgg gcc  gaa ggc gac      3249
Glu Val Ile Asn Glu Lys Thr  Asn Arg Leu Trp Ala  Glu Gly Asp
    1070                1075                1080

cgc tgg gtc atg ccg cgc gcc  agc ttc aag tcg gag  ctc gag agc      3294
Arg Trp Val Met Pro Arg Ala  Ser Phe Lys Ser Glu  Leu Glu Ser
    1085                1090                1095

cag cag caa gag ttt gat cgc  aac atg att gaa atg  ttc cgt ctt      3339
Gln Gln Gln Glu Phe Asp Arg  Asn Met Ile Glu Met  Phe Arg Leu
    1100                1105                1110

gga atc ctc acc tca att gcc  ttc acc aat ctg gcg  cgc gac gtt      3384
Gly Ile Leu Thr Ser Ile Ala  Phe Thr Asn Leu Ala  Arg Asp Val
    1115                1120                1125

ctc aac atc acg ccc aag gcc  gcc ttt ggc ctc agt  ctt ggc gag      3429
Leu Asn Ile Thr Pro Lys Ala  Ala Phe Gly Leu Ser  Leu Gly Glu
    1130                1135                1140

att tcc atg att ttt gcc ttt  tcc aag aag aac ggt  ctc atc tcc      3474
Ile Ser Met Ile Phe Ala Phe  Ser Lys Lys Asn Gly  Leu Ile Ser
    1145                1150                1155

gac cag ctc acc aag gat ctt  cgc gag tcc gac gtg  tgg aac aag      3519
Asp Gln Leu Thr Lys Asp Leu  Arg Glu Ser Asp Val  Trp Asn Lys
    1160                1165                1170

gct ctg gcc gtt gaa ttt aat  gcg ctg cgc gag gcc  tgg ggc att      3564
Ala Leu Ala Val Glu Phe Asn  Ala Leu Arg Glu Ala  Trp Gly Ile
    1175                1180                1185

cca cag agt gtc ccc aag gac  gag ttc tgg caa ggc  tac att gtg      3609
Pro Gln Ser Val Pro Lys Asp  Glu Phe Trp Gln Gly  Tyr Ile Val
    1190                1195                1200

cgc ggc acc aag cag gat atc  gag gcg gcc atc gcc  ccg gac agc      3654
Arg Gly Thr Lys Gln Asp Ile  Glu Ala Ala Ile Ala  Pro Asp Ser
    1205                1210                1215

aag tac gtg cgc ctc acc atc  atc aat gat gcc aac  acc gcc ctc      3699
Lys Tyr Val Arg Leu Thr Ile  Ile Asn Asp Ala Asn  Thr Ala Leu
    1220                1225                1230

att agc ggc aag ccc gac gcc  tgc aag gct gcg atc  gcg cgt ctc      3744
Ile Ser Gly Lys Pro Asp Ala  Cys Lys Ala Ala Ile  Ala Arg Leu
    1235                1240                1245

ggt ggc aac att cct gcg ctt  ccc gtg acc cag ggc  atg tgc ggc      3789
Gly Gly Asn Ile Pro Ala Leu  Pro Val Thr Gln Gly  Met Cys Gly
    1250                1255                1260

cac tgc ccc gag gtg gga cct  tat acc aag gat atc  gcc aag atc      3834
His Cys Pro Glu Val Gly Pro  Tyr Thr Lys Asp Ile  Ala Lys Ile
    1265                1270                1275

cat gcc aac ctt gag ttc ccc  gtt gtc gac ggc ctt  gac ctc tgg      3879
His Ala Asn Leu Glu Phe Pro  Val Val Asp Gly Leu  Asp Leu Trp
    1280                1285                1290

acc aca atc aac cag aag cgc  ctc gtg cca cgc gcc  acg ggc gcc      3924
Thr Thr Ile Asn Gln Lys Arg  Leu Val Pro Arg Ala  Thr Gly Ala
    1295                1300                1305

aag gac gaa tgg gcc cct tct  tcc ttt ggc gag tac  gcc ggc cag      3969
Lys Asp Glu Trp Ala Pro Ser  Ser Phe Gly Glu Tyr  Ala Gly Gln
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          1310                    1315                    1320

ctc tac  gag aag cag gct aac  ttc ccc caa atc gtc  gag acc att      4014
Leu Tyr  Glu Lys Gln Ala Asn  Phe Pro Gln Ile Val  Glu Thr Ile
         1325               1330                  1335

tac aag  caa aac tac gac gtc  ttt gtc gag gtt ggg  ccc aac aac      4059
Tyr Lys  Gln Asn Tyr Asp Val  Phe Val Glu Val Gly  Pro Asn Asn
         1340               1345                  1350

cac cgt  agc acc gca gtg cgc  acc acg ctt ggt ccc  cag cgc aac      4104
His Arg  Ser Thr Ala Val Arg  Thr Thr Leu Gly Pro  Gln Arg Asn
         1355               1360                  1365

cac ctt  gct ggc gcc atc gac  aag cag aac gag gat  gct tgg acg      4149
His Leu  Ala Gly Ala Ile Asp  Lys Gln Asn Glu Asp  Ala Trp Thr
         1370               1375                  1380

acc atc  gtc aag ctt gtg gct  tcg ctc aag gcc cac  ctt gtt cct      4194
Thr Ile  Val Lys Leu Val Ala  Ser Leu Lys Ala His  Leu Val Pro
         1385               1390                  1395

ggc gtc  acg atc tcg ccg ctg  tac cac tcc aag ctt  gtg gcg gag      4239
Gly Val  Thr Ile Ser Pro Leu  Tyr His Ser Lys Leu  Val Ala Glu
         1400               1405                  1410

gct cag  gct tgc tac gct gcg  ctc tgc aag ggt gaa  aag ccc aag      4284
Ala Gln  Ala Cys Tyr Ala Ala  Leu Cys Lys Gly Glu  Lys Pro Lys
         1415               1420                  1425

aag aac  aag ttt gtg cgc aag  att cag ctc aac ggt  cgc ttc aac      4329
Lys Asn  Lys Phe Val Arg Lys  Ile Gln Leu Asn Gly  Arg Phe Asn
         1430               1435                  1440

agc aag  gcg gac ccc atc tcc  tcg gcc gat ctt gcc  agc ttt ccg      4374
Ser Lys  Ala Asp Pro Ile Ser  Ser Ala Asp Leu Ala  Ser Phe Pro
         1445               1450                  1455

cct gcg  gac cct gcc att gaa  gcc gcc atc tcg agc  cgc atc atg      4419
Pro Ala  Asp Pro Ala Ile Glu  Ala Ala Ile Ser Ser  Arg Ile Met
         1460               1465                  1470

aag cct  gtc gct ccc aag ttc  tac gcg cgt ctc aac  att gac gag      4464
Lys Pro  Val Ala Pro Lys Phe  Tyr Ala Arg Leu Asn  Ile Asp Glu
         1475               1480                  1485

cag gac  gag acc cga gat ccg  atc ctc aac aag gac  aac gcg ccg      4509
Gln Asp  Glu Thr Arg Asp Pro  Ile Leu Asn Lys Asp  Asn Ala Pro
         1490               1495                  1500

tct tct  tct tct tct tct tct  tct tct tct tct tct  tct tct tct      4554
Ser Ser  Ser Ser Ser Ser Ser  Ser Ser Ser Ser Ser  Ser Ser Ser
         1505               1510                  1515

ccg tcg  cct gct cct tcg gcc  ccc gtg caa aag aag  gct gct ccc      4599
Pro Ser  Pro Ala Pro Ser Ala  Pro Val Gln Lys Lys  Ala Ala Pro
         1520               1525                  1530

gcc gcg  gag acc aag gct gtt  gct tcg gct gac gca  ctt cgc agt      4644
Ala Ala  Glu Thr Lys Ala Val  Ala Ser Ala Asp Ala  Leu Arg Ser
         1535               1540                  1545

gcc ctg  ctc gat ctc gac agt  atg ctt gcg ctg agc  tct gcc agt      4689
Ala Leu  Leu Asp Leu Asp Ser  Met Leu Ala Leu Ser  Ser Ala Ser
         1550               1555                  1560

gcc tcc  ggc aac ctt gtt gag  act gcg cct agc gac  gcc tcg gtc      4734
Ala Ser  Gly Asn Leu Val Glu  Thr Ala Pro Ser Asp  Ala Ser Val
```

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        1565                    1570                    1575

att gtg  ccg ccc tgc aac att  gcg gat ctc ggc agc  cgc gcc ttc     4779
Ile Val  Pro Pro Cys Asn Ile  Ala Asp Leu Gly Ser  Arg Ala Phe
        1580                    1585                    1590

atg aaa  acg tac ggt gtt tcg  gcg cct ctg tac acg  ggc gcc atg     4824
Met Lys  Thr Tyr Gly Val Ser  Ala Pro Leu Tyr Thr  Gly Ala Met
        1595                    1600                    1605

gcc aag  ggc att gcc tct gcg  gac ctc gtc att gcc  gcc ggc cgc     4869
Ala Lys  Gly Ile Ala Ser Ala  Asp Leu Val Ile Ala  Ala Gly Arg
        1610                    1615                    1620

cag ggc  atc ctt gcg tcc ttt  ggc gcc ggc gga ctt  ccc atg cag     4914
Gln Gly  Ile Leu Ala Ser Phe  Gly Ala Gly Gly Leu  Pro Met Gln
        1625                    1630                    1635

gtt gtg  cgt gag tcc atc gaa  aag att cag gcc gcc  ctg ccc aat     4959
Val Val  Arg Glu Ser Ile Glu  Lys Ile Gln Ala Ala  Leu Pro Asn
        1640                    1645                    1650

ggc ccg  tac gct gtc aac ctt  atc cat tct ccc ttt  gac agc aac     5004
Gly Pro  Tyr Ala Val Asn Leu  Ile His Ser Pro Phe  Asp Ser Asn
        1655                    1660                    1665

ctc gaa  aag ggc aat gtc gat  ctc ttc ctc gag aag  ggt gtc acc     5049
Leu Glu  Lys Gly Asn Val Asp  Leu Phe Leu Glu Lys  Gly Val Thr
        1670                    1675                    1680

ttt gtc  gag gcc tcg gcc ttt  atg acg ctc acc ccg  cag gtc gtg     5094
Phe Val  Glu Ala Ser Ala Phe  Met Thr Leu Thr Pro  Gln Val Val
        1685                    1690                    1695

cgg tac  cgc gcg gct ggc ctc  acg cgc aac gcc gac  ggc tcg gtc     5139
Arg Tyr  Arg Ala Ala Gly Leu  Thr Arg Asn Ala Asp  Gly Ser Val
        1700                    1705                    1710

aac atc  cgc aac cgt atc att  ggc aag gtc tcg cgc  acc gag ctc     5184
Asn Ile  Arg Asn Arg Ile Ile  Gly Lys Val Ser Arg  Thr Glu Leu
        1715                    1720                    1725

gcc gag  atg ttc atg cgt cct  gcg ccc gag cac ctt  ctt cag aag     5229
Ala Glu  Met Phe Met Arg Pro  Ala Pro Glu His Leu  Leu Gln Lys
        1730                    1735                    1740

ctc att  gct tcc ggc gag atc  aac cag gag cag gcc  gag ctc gcc     5274
Leu Ile  Ala Ser Gly Glu Ile  Asn Gln Glu Gln Ala  Glu Leu Ala
        1745                    1750                    1755

cgc cgt  gtt ccc gtc gct gac  gac atc gcg gtc gaa  gct gac tcg     5319
Arg Arg  Val Pro Val Ala Asp  Asp Ile Ala Val Glu  Ala Asp Ser
        1760                    1765                    1770

ggt ggc  cac acc gac aac cgc  ccc atc cac gtc att  ctg ccc ctc     5364
Gly Gly  His Thr Asp Asn Arg  Pro Ile His Val Ile  Leu Pro Leu
        1775                    1780                    1785

atc atc  aac ctt cgc gac cgc  ctt cac cgc gag tgc  ggc tac ccg     5409
Ile Ile  Asn Leu Arg Asp Arg  Leu His Arg Glu Cys  Gly Tyr Pro
        1790                    1795                    1800

gcc aac  ctt cgc gtc cgt gtg  ggc gcc ggc ggt ggc  att ggg tgc     5454
Ala Asn  Leu Arg Val Arg Val  Gly Ala Gly Gly Gly  Ile Gly Cys
        1805                    1810                    1815

ccc cag  gcg gcg ctg gcc acc  ttc aac atg ggt gcc  tcc ttt att     5499
Pro Gln  Ala Ala Leu Ala Thr  Phe Asn Met Gly Ala  Ser Phe Ile
```

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        1820                      1825                     1830

gtc acc ggc acc gtg aac cag  gtc gcc aag cag tcg  ggc acg tgc          5544
Val Thr Gly Thr Val Asn Gln  Val Ala Lys Gln Ser  Gly Thr Cys
    1835                 1840                 1845

gac aat gtg cgc aag cag ctc  gcg aag gcc act tac  tcg gac gta          5589
Asp Asn Val Arg Lys Gln Leu  Ala Lys Ala Thr Tyr  Ser Asp Val
    1850                 1855                 1860

tgc atg gcc ccg gct gcc gac  atg ttc gag gaa ggc  gtc aag ctt          5634
Cys Met Ala Pro Ala Ala Asp  Met Phe Glu Glu Gly  Val Lys Leu
    1865                 1870                 1875

cag gtc ctc aag aag gga acc  atg ttt ccc tcg cgc  gcc aac aag          5679
Gln Val Leu Lys Lys Gly Thr  Met Phe Pro Ser Arg  Ala Asn Lys
    1880                 1885                 1890

ctc tac gag ctc ttt tgc aag  tac gac tcg ttc gag  tcc atg ccc          5724
Leu Tyr Glu Leu Phe Cys Lys  Tyr Asp Ser Phe Glu  Ser Met Pro
    1895                 1900                 1905

ccc gca gag ctt gcg cgc gtc  gag aag cgc atc ttc  agc cgc gcg          5769
Pro Ala Glu Leu Ala Arg Val  Glu Lys Arg Ile Phe  Ser Arg Ala
    1910                 1915                 1920

ctc gaa gag gtc tgg gac gag  acc aaa aac ttt tac  att aac cgt          5814
Leu Glu Glu Val Trp Asp Glu  Thr Lys Asn Phe Tyr  Ile Asn Arg
    1925                 1930                 1935

ctt cac aac ccg gag aag atc  cag cgc gcc gag cgc  gac ccc aag          5859
Leu His Asn Pro Glu Lys Ile  Gln Arg Ala Glu Arg  Asp Pro Lys
    1940                 1945                 1950

ctc aag atg tcg ctg tgc ttt  cgc tgg tac ctg agc  ctg gcg agc          5904
Leu Lys Met Ser Leu Cys Phe  Arg Trp Tyr Leu Ser  Leu Ala Ser
    1955                 1960                 1965

cgc tgg gcc aac act gga gct  tcc gat cgc gtc atg  gac tac cag          5949
Arg Trp Ala Asn Thr Gly Ala  Ser Asp Arg Val Met  Asp Tyr Gln
    1970                 1975                 1980

gtc tgg tgc ggt cct gcc att  ggt tcc ttc aac gat  ttc atc aag          5994
Val Trp Cys Gly Pro Ala Ile  Gly Ser Phe Asn Asp  Phe Ile Lys
    1985                 1990                 1995

gga act tac ctt gat ccg gcc  gtc gca aac gag tac  ccg tgc gtc          6039
Gly Thr Tyr Leu Asp Pro Ala  Val Ala Asn Glu Tyr  Pro Cys Val
    2000                 2005                 2010

gtt cag att aac aag cag atc  ctt cgt gga gcg tgc  ttc ttg cgc          6084
Val Gln Ile Asn Lys Gln Ile  Leu Arg Gly Ala Cys  Phe Leu Arg
    2015                 2020                 2025

cgt ctc gaa att ctg cgc aac  gca cgc ctt tcc gat  ggc gct gcc          6129
Arg Leu Glu Ile Leu Arg Asn  Ala Arg Leu Ser Asp  Gly Ala Ala
    2030                 2035                 2040

gct ctt gtg gcc agc atc gat  gac aca tac gtc ccg  gcc gag aag          6174
Ala Leu Val Ala Ser Ile Asp  Asp Thr Tyr Val Pro  Ala Glu Lys
    2045                 2050                 2055

ctg                                                                    6177
Leu


<210>   4
```

```
<211>  2059
<212>  PRT
<213>  Schizochytrium sp.

<220>
<221>  misc_feature
<222>  (370)..(370)
<223>  The 'Xaa' at location 370 stands for Leu.

<220>
<221>  misc_feature
<222>  (371)..(371)
<223>  The 'Xaa' at location 371 stands for Ala, or Val.

<400>  4

Met Ala Ala Arg Asn Val Ser Ala Ala His Glu Met His Asp Glu Lys
1               5                   10                  15


Arg Ile Ala Val Val Gly Met Ala Val Gln Tyr Ala Gly Cys Lys Thr
            20                  25                  30


Lys Asp Glu Phe Trp Glu Val Leu Met Asn Gly Lys Val Glu Ser Lys
        35                  40                  45


Val Ile Ser Asp Lys Arg Leu Gly Ser Asn Tyr Arg Ala Glu His Tyr
    50                  55                  60


Lys Ala Glu Arg Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Thr Tyr
65                  70                  75                  80


Gly Thr Leu Asp Glu Asn Glu Ile Asp Asn Glu His Glu Leu Leu Leu
            85                  90                  95


Asn Leu Ala Lys Gln Ala Leu Ala Glu Thr Ser Val Lys Asp Ser Thr
            100                 105                 110


Arg Cys Gly Ile Val Ser Gly Cys Leu Ser Phe Pro Met Asp Asn Leu
        115                 120                 125


Gln Gly Glu Leu Leu Asn Val Tyr Gln Asn His Val Glu Lys Lys Leu
        130                 135                 140


Gly Ala Arg Val Phe Lys Asp Ala Ser His Trp Ser Glu Arg Glu Gln
145                 150                 155                 160


Ser Asn Lys Pro Glu Ala Gly Asp Arg Arg Ile Phe Met Asp Pro Ala
                165                 170                 175


Ser Phe Val Ala Glu Glu Leu Asn Leu Gly Ala Leu His Tyr Ser Val
            180                 185                 190


Asp Ala Ala Cys Ala Thr Ala Leu Tyr Val Leu Arg Leu Ala Gln Asp
            195                 200                 205
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His Leu Val Ser Gly Ala Ala Asp Val Met Leu Cys Gly Ala Thr Cys
    210              215              220

Leu Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe Ser Thr Phe Gln Ala
225              230              235                  240

Met Pro Val Gly Thr Gly Gln Asn Val Ser Met Pro Leu His Lys Asp
            245              250                  255

Ser Gln Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile Met Val Leu Lys
            260              265              270

Arg Leu Asp Asp Ala Ile Arg Asp Gly Asp His Ile Tyr Gly Thr Leu
        275              280              285

Leu Gly Ala Asn Val Ser Asn Ser Gly Thr Gly Leu Pro Leu Lys Pro
    290              295              300

Leu Leu Pro Ser Glu Lys Lys Cys Leu Met Asp Thr Tyr Thr Arg Ile
305              310              315              320

Asn Val His Pro His Lys Ile Gln Tyr Val Glu Cys His Ala Thr Gly
            325              330              335

Thr Pro Gln Gly Asp Arg Val Glu Ile Asp Ala Val Lys Ala Cys Phe
            340              345              350

Glu Gly Lys Val Pro Arg Phe Gly Thr Thr Lys Gly Asn Phe Gly His
        355              360              365

Thr Xaa Xaa Ala Ala Gly Phe Ala Gly Met Cys Lys Val Leu Leu Ser
    370              375              380

Met Lys His Gly Ile Ile Pro Pro Thr Pro Gly Ile Asp Asp Glu Thr
385              390              395              400

Lys Met Asp Pro Leu Val Val Ser Gly Glu Ala Ile Pro Trp Pro Glu
            405              410              415

Thr Asn Gly Glu Pro Lys Arg Ala Gly Leu Ser Ala Phe Gly Phe Gly
            420              425              430

Gly Thr Asn Ala His Ala Val Phe Glu Glu His Asp Pro Ser Asn Ala
        435              440              445

Ala Cys Thr Gly His Asp Ser Ile Ser Ala Leu Ser Ala Arg Cys Gly
    450              455              460

Gly Glu Ser Asn Met Arg Ile Ala Ile Thr Gly Met Asp Ala Thr Phe
465              470              475              480
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```
Gly Ala Leu Lys Gly Leu Asp Ala Phe Glu Arg Ala Ile Tyr Thr Gly
            485                 490                 495

Ala His Gly Ala Ile Pro Leu Pro Glu Lys Arg Trp Arg Phe Leu Gly
            500                 505                 510

Lys Asp Lys Asp Phe Leu Asp Leu Cys Gly Val Lys Ala Thr Pro His
            515                 520                 525

Gly Cys Tyr Ile Glu Asp Val Glu Val Asp Phe Gln Arg Leu Arg Thr
    530                 535                 540

Pro Met Thr Pro Glu Asp Met Leu Leu Pro Gln Gln Leu Leu Ala Val
545                 550                 555                 560

Thr Thr Ile Asp Arg Ala Ile Leu Asp Ser Gly Met Lys Lys Gly Gly
            565                 570                 575

Asn Val Ala Val Phe Val Gly Leu Gly Thr Asp Leu Glu Leu Tyr Arg
            580                 585                 590

His Arg Ala Arg Val Ala Leu Lys Glu Arg Val Arg Pro Glu Ala Ser
    595                 600                 605

Lys Lys Leu Asn Asp Met Met Gln Tyr Ile Asn Asp Cys Gly Thr Ser
    610                 615                 620

Thr Ser Tyr Thr Ser Tyr Ile Gly Asn Leu Val Ala Thr Arg Val Ser
625                 630                 635                 640

Ser Gln Trp Gly Phe Thr Gly Pro Ser Phe Thr Ile Thr Glu Gly Asn
            645                 650                 655

Asn Ser Val Tyr Arg Cys Ala Glu Leu Gly Lys Tyr Leu Leu Glu Thr
            660                 665                 670

Gly Glu Val Asp Gly Val Val Val Ala Gly Val Asp Leu Cys Gly Ser
            675                 680                 685

Ala Glu Asn Leu Tyr Val Lys Ser Arg Arg Phe Lys Val Ser Thr Ser
    690                 695                 700

Asp Thr Pro Arg Ala Ser Phe Asp Ala Ala Ala Asp Gly Tyr Phe Val
705                 710                 715                 720

Gly Glu Gly Cys Gly Ala Phe Val Leu Lys Arg Glu Thr Ser Cys Thr
            725                 730                 735

Lys Asp Asp Arg Ile Tyr Ala Cys Met Asp Ala Ile Val Pro Gly Asn
            740                 745                 750
```

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Val Pro Ser Ala Cys Leu Arg Glu Ala Leu Asp Gln Ala Arg Val Lys
        755   760   765

Pro Gly Asp Ile Glu Met Leu Glu Leu Ser Ala Asp Ser Ala Arg His
        770   775   780

Leu Lys Asp Pro Ser Val Leu Pro Lys Glu Leu Thr Ala Glu Glu Glu
785   790   795   800

Ile Gly Gly Leu Gln Thr Ile Leu Arg Asp Asp Asp Lys Leu Pro Arg
                805   810   815

Asn Val Ala Thr Gly Ser Val Lys Ala Thr Val Gly Asp Thr Gly Tyr
            820   825   830

Ala Ser Gly Ala Ala Ser Leu Ile Lys Ala Ala Leu Cys Ile Tyr Asn
        835   840   845

Arg Tyr Leu Pro Ser Asn Gly Asp Asp Trp Asp Glu Pro Ala Pro Glu
    850   855   860

Ala Pro Trp Asp Ser Thr Leu Phe Ala Cys Gln Thr Ser Arg Ala Trp
865   870   875   880

Leu Lys Asn Pro Gly Glu Arg Arg Tyr Ala Ala Val Ser Gly Val Ser
                885   890   895

Glu Thr Arg Ser Cys Tyr Ser Val Leu Leu Ser Glu Ala Glu Gly His
            900   905   910

Tyr Glu Arg Glu Asn Arg Ile Ser Leu Asp Glu Glu Ala Pro Lys Leu
        915   920   925

Ile Val Leu Arg Ala Asp Ser His Glu Glu Ile Leu Gly Arg Leu Asp
    930   935   940

Lys Ile Arg Glu Arg Phe Leu Gln Pro Thr Gly Ala Ala Pro Arg Glu
945   950   955   960

Ser Glu Leu Lys Ala Gln Ala Arg Arg Ile Phe Leu Glu Leu Leu Gly
                965   970   975

Glu Thr Leu Ala Gln Asp Ala Ala Ser Ser Gly Ser Gln Lys Pro Leu
            980   985   990

Ala Leu Ser Leu Val Ser Thr Pro Ser Lys Leu Gln Arg Glu Val Glu
        995   1000   1005

Leu Ala Ala Lys Gly Ile Pro Arg Cys Leu Lys Met Arg Arg Asp
    1010   1015   1020

Trp Ser Ser Pro Ala Gly Ser Arg Tyr Ala Pro Glu Pro Leu Ala
    1025   1030   1035

Ser Asp Arg Val Ala Phe Met Tyr Gly Glu Gly Arg Ser Pro Tyr
    1040   1045   1050

Tyr Gly Ile Thr Gln Asp Ile His Arg Ile Trp Pro Glu Leu His
    1055   1060   1065

Glu Val Ile Asn Glu Lys Thr Asn Arg Leu Trp Ala Glu Gly Asp
    1070   1075   1080

Arg Trp Val Met Pro Arg Ala Ser Phe Lys Ser Glu Leu Glu Ser
    1085   1090   1095

Gln Gln Gln Glu Phe Asp Arg Asn Met Ile Glu Met Phe Arg Leu
    1100   1105   1110

Gly Ile Leu Thr Ser Ile Ala Phe Thr Asn Leu Ala Arg Asp Val
    1115   1120   1125

Leu Asn Ile Thr Pro Lys Ala Ala Phe Gly Leu Ser Leu Gly Glu
    1130   1135   1140

Ile Ser Met Ile Phe Ala Phe Ser Lys Lys Asn Gly Leu Ile Ser
    1145   1150   1155

Asp Gln Leu Thr Lys Asp Leu Arg Glu Ser Asp Val Trp Asn Lys
    1160   1165   1170

Ala Leu Ala Val Glu Phe Asn Ala Leu Arg Glu Ala Trp Gly Ile
    1175   1180   1185

Pro Gln Ser Val Pro Lys Asp Glu Phe Trp Gln Gly Tyr Ile Val
    1190   1195   1200

Arg Gly Thr Lys Gln Asp Ile Glu Ala Ala Ile Ala Pro Asp Ser
    1205   1210   1215

Lys Tyr Val Arg Leu Thr Ile Ile Asn Asp Ala Asn Thr Ala Leu
    1220   1225   1230

Ile Ser Gly Lys Pro Asp Ala Cys Lys Ala Ala Ile Ala Arg Leu
    1235   1240   1245

Gly Gly Asn Ile Pro Ala Leu Pro Val Thr Gln Gly Met Cys Gly
    1250   1255   1260

His Cys Pro Glu Val Gly Pro Tyr Thr Lys Asp Ile Ala Lys Ile
    1265   1270   1275

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His Ala  Asn Leu Glu Phe Pro  Val Val Asp Gly Leu  Asp Leu Trp
    1280             1285               1290

Thr Thr  Ile Asn Gln Lys Arg  Leu Val Pro Arg Ala  Thr Gly Ala
    1295             1300               1305

Lys Asp  Glu Trp Ala Pro Ser  Ser Phe Gly Glu Tyr  Ala Gly Gln
    1310             1315               1320

Leu Tyr  Glu Lys Gln Ala Asn  Phe Pro Gln Ile Val  Glu Thr Ile
    1325             1330               1335

Tyr Lys  Gln Asn Tyr Asp Val  Phe Val Glu Val Gly  Pro Asn Asn
    1340             1345               1350

His Arg  Ser Thr Ala Val Arg  Thr Thr Leu Gly Pro  Gln Arg Asn
    1355             1360               1365

His Leu  Ala Gly Ala Ile Asp  Lys Gln Asn Glu Asp  Ala Trp Thr
    1370             1375               1380

Thr Ile  Val Lys Leu Val Ala  Ser Leu Lys Ala His  Leu Val Pro
    1385             1390               1395

Gly Val  Thr Ile Ser Pro Leu  Tyr His Ser Lys Leu  Val Ala Glu
    1400             1405               1410

Ala Gln  Ala Cys Tyr Ala Ala  Leu Cys Lys Gly Glu  Lys Pro Lys
    1415             1420               1425

Lys Asn  Lys Phe Val Arg Lys  Ile Gln Leu Asn Gly  Arg Phe Asn
    1430             1435               1440

Ser Lys  Ala Asp Pro Ile Ser  Ser Ala Asp Leu Ala  Ser Phe Pro
    1445             1450               1455

Pro Ala  Asp Pro Ala Ile Glu  Ala Ala Ile Ser Ser  Arg Ile Met
    1460             1465               1470

Lys Pro  Val Ala Pro Lys Phe  Tyr Ala Arg Leu Asn  Ile Asp Glu
    1475             1480               1485

Gln Asp  Glu Thr Arg Asp Pro  Ile Leu Asn Lys Asp  Asn Ala Pro
    1490             1495               1500

Ser Ser  Ser Ser Ser Ser Ser  Ser Ser Ser Ser Ser  Ser Ser Ser
    1505             1510               1515

Pro Ser  Pro Ala Pro Ser Ala  Pro Val Gln Lys Lys  Ala Ala Pro
    1520             1525               1530
```

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```
Ala Ala  Glu Thr Lys Ala Val  Ala Ser Ala Asp Ala  Leu Arg Ser
    1535                1540                1545

Ala Leu  Leu Asp Leu Asp Ser  Met Leu Ala Leu Ser  Ser Ala Ser
    1550                1555                1560

Ala Ser  Gly Asn Leu Val Glu  Thr Ala Pro Ser Asp  Ala Ser Val
    1565                1570                1575

Ile Val  Pro Pro Cys Asn Ile  Ala Asp Leu Gly Ser  Arg Ala Phe
    1580                1585                1590

Met Lys  Thr Tyr Gly Val Ser  Ala Pro Leu Tyr Thr  Gly Ala Met
    1595                1600                1605

Ala Lys  Gly Ile Ala Ser Ala  Asp Leu Val Ile Ala  Ala Gly Arg
    1610                1615                1620

Gln Gly  Ile Leu Ala Ser Phe  Gly Ala Gly Gly Leu  Pro Met Gln
    1625                1630                1635

Val Val  Arg Glu Ser Ile Glu  Lys Ile Gln Ala Ala  Leu Pro Asn
    1640                1645                1650

Gly Pro  Tyr Ala Val Asn Leu  Ile His Ser Pro Phe  Asp Ser Asn
    1655                1660                1665

Leu Glu  Lys Gly Asn Val Asp  Leu Phe Leu Glu Lys  Gly Val Thr
    1670                1675                1680

Phe Val  Glu Ala Ser Ala Phe  Met Thr Leu Thr Pro  Gln Val Val
    1685                1690                1695

Arg Tyr  Arg Ala Ala Gly Leu  Thr Arg Asn Ala Asp  Gly Ser Val
    1700                1705                1710

Asn Ile  Arg Asn Arg Ile Ile  Gly Lys Val Ser Arg  Thr Glu Leu
    1715                1720                1725

Ala Glu  Met Phe Met Arg Pro  Ala Pro Glu His Leu  Leu Gln Lys
    1730                1735                1740

Leu Ile  Ala Ser Gly Glu Ile  Asn Gln Glu Gln Ala  Glu Leu Ala
    1745                1750                1755

Arg Arg  Val Pro Val Ala Asp  Asp Ile Ala Val Glu  Ala Asp Ser
    1760                1765                1770

Gly Gly  His Thr Asp Asn Arg  Pro Ile His Val Ile  Leu Pro Leu
    1775                1780                1785
```

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```
Ile Ile  Asn Leu Arg Asp Arg  Leu His Arg Glu Cys  Gly Tyr Pro
    1790             1795             1800

Ala Asn  Leu Arg Val Arg Val  Gly Ala Gly Gly Gly  Ile Gly Cys
    1805             1810             1815

Pro Gln  Ala Ala Leu Ala Thr  Phe Asn Met Gly Ala  Ser Phe Ile
    1820             1825             1830

Val Thr  Gly Thr Val Asn Gln  Val Ala Lys Gln Ser  Gly Thr Cys
    1835             1840             1845

Asp Asn  Val Arg Lys Gln Leu  Ala Lys Ala Thr Tyr  Ser Asp Val
    1850             1855             1860

Cys Met  Ala Pro Ala Ala Asp  Met Phe Glu Glu Gly  Val Lys Leu
    1865             1870             1875

Gln Val  Leu Lys Lys Gly Thr  Met Phe Pro Ser Arg  Ala Asn Lys
    1880             1885             1890

Leu Tyr  Glu Leu Phe Cys Lys  Tyr Asp Ser Phe Glu  Ser Met Pro
    1895             1900             1905

Pro Ala  Glu Leu Ala Arg Val  Glu Lys Arg Ile Phe  Ser Arg Ala
    1910             1915             1920

Leu Glu  Glu Val Trp Asp Glu  Thr Lys Asn Phe Tyr  Ile Asn Arg
    1925             1930             1935

Leu His  Asn Pro Glu Lys Ile  Gln Arg Ala Glu Arg  Asp Pro Lys
    1940             1945             1950

Leu Lys  Met Ser Leu Cys Phe  Arg Trp Tyr Leu Ser  Leu Ala Ser
    1955             1960             1965

Arg Trp  Ala Asn Thr Gly Ala  Ser Asp Arg Val Met  Asp Tyr Gln
    1970             1975             1980

Val Trp  Cys Gly Pro Ala Ile  Gly Ser Phe Asn Asp  Phe Ile Lys
    1985             1990             1995

Gly Thr  Tyr Leu Asp Pro Ala  Val Ala Asn Glu Tyr  Pro Cys Val
    2000             2005             2010

Val Gln  Ile Asn Lys Gln Ile  Leu Arg Gly Ala Cys  Phe Leu Arg
    2015             2020             2025

Arg Leu  Glu Ile Leu Arg Asn  Ala Arg Leu Ser Asp  Gly Ala Ala
    2030             2035             2040
```

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Ala Leu  Val Ala Ser Ile Asp  Asp Thr Tyr Val Pro  Ala Glu Lys
    2045                2050               2055


Leu


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<212>  DNA
<213>  Schizochytrium sp.


<220>
<221>  CDS
<222>  (1)..(4509)

<400>  5
atg gcg ctc cgt gtc aag acg aac aag aag cca tgc tgg gag atg acc      48
Met Ala Leu Arg Val Lys Thr Asn Lys Lys Pro Cys Trp Glu Met Thr
1               5                   10                  15

aag gag gag ctg acc agc ggc aag acc gag gtg ttc aac tat gag gaa      96
Lys Glu Glu Leu Thr Ser Gly Lys Thr Glu Val Phe Asn Tyr Glu Glu
                20                  25                  30

ctc ctc gag ttc gca gag ggc gac atc gcc aag gtc ttc gga ccc gag     144
Leu Leu Glu Phe Ala Glu Gly Asp Ile Ala Lys Val Phe Gly Pro Glu
            35                  40                  45

ttc gcc gtc atc gac aag tac ccg cgc cgc gtg cgc ctg ccc gcc cgc     192
Phe Ala Val Ile Asp Lys Tyr Pro Arg Arg Val Arg Leu Pro Ala Arg
        50                  55                  60

gag tac ctg ctc gtg acc cgc gtc acc ctc atg gac gcc gag gtc aac     240
Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Asn
65                  70                  75                  80

aac tac cgc gtc ggc gcc cgc atg gtc acc gag tac gat ctc ccc gtc     288
Asn Tyr Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Leu Pro Val
                85                  90                  95

aac gga gag ctc tcc gag ggc gga gac tgc ccc tgg gcc gtc ctg gtc     336
Asn Gly Glu Leu Ser Glu Gly Gly Asp Cys Pro Trp Ala Val Leu Val
                100                 105                 110

gag agt ggc cag tgc gat ctc atg ctc atc tcc tac atg ggc att gac     384
Glu Ser Gly Gln Cys Asp Leu Met Leu Ile Ser Tyr Met Gly Ile Asp
            115                 120                 125

ttc cag aac cag ggc gac cgc gtc tac cgc ctg ctc aac acc acg ctc     432
Phe Gln Asn Gln Gly Asp Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu
        130                 135                 140

acc ttt tac ggc gtg gcc cac gag ggc gag acc ctc gag tac gac att     480
Thr Phe Tyr Gly Val Ala His Glu Gly Glu Thr Leu Glu Tyr Asp Ile
145                 150                 155                 160

cgc gtc acc ggc ttc gcc aag cgt ctc gac ggc ggc atc tcc atg ttc     528
Arg Val Thr Gly Phe Ala Lys Arg Leu Asp Gly Gly Ile Ser Met Phe
                165                 170                 175

ttc ttc gag tac gac tgc tac gtc aac ggc cgc ctc ctc atc gag atg     576
Phe Phe Glu Tyr Asp Cys Tyr Val Asn Gly Arg Leu Leu Ile Glu Met
                180                 185                 190

cgc gat ggc tgc gcc ggc ttc ttc acc aac gag gag ctc gac gcc ggc     624
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40

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    Arg Asp Gly Cys Ala Gly Phe Phe Thr Asn Glu Glu Leu Asp Ala Gly
        195                 200             205

aag ggc gtc gtc ttc acc cgc ggc gac ctc gcc gcc cgc gcc aag atc        672
Lys Gly Val Val Phe Thr Arg Gly Asp Leu Ala Ala Arg Ala Lys Ile
    210             215             220

cca aag cag gac gtc tcc ccc tac gcc gtc gcc ccc tgc ctc cac aag        720
Pro Lys Gln Asp Val Ser Pro Tyr Ala Val Ala Pro Cys Leu His Lys
225             230             235             240

acc aag ctc aac gaa aag gag atg cag acc ctc gtc gac aag gac tgg        768
Thr Lys Leu Asn Glu Lys Glu Met Gln Thr Leu Val Asp Lys Asp Trp
                245             250             255

gca tcc gtc ttt ggc tcc aag aac ggc atg ccg gaa atc aac tac aaa        816
Ala Ser Val Phe Gly Ser Lys Asn Gly Met Pro Glu Ile Asn Tyr Lys
                260             265             270

ctc tgc gcg cgt aag atg ctc atg att gac cgc gtc acc agc att gac        864
Leu Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr Ser Ile Asp
            275             280             285

cac aag ggc ggt gtc tac ggc ctc ggt cag ctc gtc ggt gaa aag atc        912
His Lys Gly Gly Val Tyr Gly Leu Gly Gln Leu Val Gly Glu Lys Ile
    290             295             300

ctc gag cgc gac cac tgg tac ttt ccc tgc cac ttt gtc aag gat cag        960
Leu Glu Arg Asp His Trp Tyr Phe Pro Cys His Phe Val Lys Asp Gln
305             310             315             320

gtc atg gcc gga tcc ctc gtc tcc gac ggc tgc agc cag atg ctc aag       1008
Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Met Leu Lys
                325             330             335

atg tac atg atc tgg ctc ggc ctc cac ctc acc acc gga ccc ttt gac       1056
Met Tyr Met Ile Trp Leu Gly Leu His Leu Thr Thr Gly Pro Phe Asp
            340             345             350

ttc cgc ccg gtc aac ggc cac ccc aac aag gtc cgc tgc cgc ggc caa       1104
Phe Arg Pro Val Asn Gly His Pro Asn Lys Val Arg Cys Arg Gly Gln
            355             360             365

atc tcc ccg cac aag ggc aag ctc gtc tac gtc atg gag atc aag gag       1152
Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Glu
    370             375             380

atg ggc ttc gac gag gac aac gac ccg tac gcc att gcc gac gtc aac       1200
Met Gly Phe Asp Glu Asp Asn Asp Pro Tyr Ala Ile Ala Asp Val Asn
385             390             395             400

atc att gat gtc gac ttc gaa aag ggc cag gac ttt agc ctc gac cgc       1248
Ile Ile Asp Val Asp Phe Glu Lys Gly Gln Asp Phe Ser Leu Asp Arg
                405             410             415

atc agc gac tac ggc aag ggc gac ctc aac aag aag atc gtc gtc gac       1296
Ile Ser Asp Tyr Gly Lys Gly Asp Leu Asn Lys Lys Ile Val Val Asp
            420             425             430

ttt aag ggc atc gct ctc aag atg cag aag cgc tcc acc aac aag aac       1344
Phe Lys Gly Ile Ala Leu Lys Met Gln Lys Arg Ser Thr Asn Lys Asn
        435             440             445

ccc tcc aag gtt cag ccc gtc ttt gcc aac ggc gcc gcc act gtc ggc       1392
Pro Ser Lys Val Gln Pro Val Phe Ala Asn Gly Ala Ala Thr Val Gly
    450             455             460

ccc gag gcc tcc aag gct tcc tcc ggc gcc agc gcc agc gcc agc gcc       1440
```

41

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Pro Glu Ala Ser Lys Ala Ser Ser Gly Ala Ser Ala Ser Ala Ser Ala
465             470             475                 480

gcc ccg gcc aag cct gcc ttc agc gcc gat gtt ctt gcg ccc aag ccc        1488
Ala Pro Ala Lys Pro Ala Phe Ser Ala Asp Val Leu Ala Pro Lys Pro
                485             490                 495

gtt gcc ctt ccc gag cac atc ctc aag ggc gac gcc ctc gcc ccc aag        1536
Val Ala Leu Pro Glu His Ile Leu Lys Gly Asp Ala Leu Ala Pro Lys
            500             505             510

gag atg tcc tgg cac ccc atg gcc cgc atc ccg ggc aac ccg acg ccc        1584
Glu Met Ser Trp His Pro Met Ala Arg Ile Pro Gly Asn Pro Thr Pro
            515             520             525

tct ttt gcg ccc tcg gcc tac aag ccg cgc aac atc gcc ttt acg ccc        1632
Ser Phe Ala Pro Ser Ala Tyr Lys Pro Arg Asn Ile Ala Phe Thr Pro
            530             535             540

ttc ccc ggc aac ccc aac gat aac gac cac acc ccg ggc aag atg ccg        1680
Phe Pro Gly Asn Pro Asn Asp Asn Asp His Thr Pro Gly Lys Met Pro
545             550             555                 560

ctc acc tgg ttc aac atg gcc gag ttc atg gcc ggc aag gtc agc atg        1728
Leu Thr Trp Phe Asn Met Ala Glu Phe Met Ala Gly Lys Val Ser Met
                565             570             575

tgc ctc ggc ccc gag ttc gcc aag ttc gac gac tcg aac acc agc cgc        1776
Cys Leu Gly Pro Glu Phe Ala Lys Phe Asp Asp Ser Asn Thr Ser Arg
            580             585             590

agc ccc gct tgg gac ctc gct ctc gtc acc cgc gcc gtg tct gtg tct        1824
Ser Pro Ala Trp Asp Leu Ala Leu Val Thr Arg Ala Val Ser Val Ser
            595             600             605

gac ctc aag cac gtc aac tac cgc aac atc gac ctc gac ccc tcc aag        1872
Asp Leu Lys His Val Asn Tyr Arg Asn Ile Asp Leu Asp Pro Ser Lys
            610             615             620

ggt acc atg gtc ggc gag ttc gac tgc ccc gcg gac gcc tgg ttc tac        1920
Gly Thr Met Val Gly Glu Phe Asp Cys Pro Ala Asp Ala Trp Phe Tyr
625             630             635                 640

aag ggc gcc tgc aac gat gcc cac atg ccg tac tcg atc ctc atg gag        1968
Lys Gly Ala Cys Asn Asp Ala His Met Pro Tyr Ser Ile Leu Met Glu
                645             650             655

atc gcc ctc cag acc tcg ggt gtg ctc acc tcg gtg ctc aag gcg ccc        2016
Ile Ala Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu Lys Ala Pro
                660             665             670

ctg acc atg gag aag gac gac atc ctc ttc cgc aac ctc gac gcc aac        2064
Leu Thr Met Glu Lys Asp Asp Ile Leu Phe Arg Asn Leu Asp Ala Asn
            675             680             685

gcc gag ttc gtg cgc gcc gac ctc gac tac cgc ggc aag act atc cgc        2112
Ala Glu Phe Val Arg Ala Asp Leu Asp Tyr Arg Gly Lys Thr Ile Arg
            690             695             700

aac gtc acc aag tgc act ggc tac agc atg ctc ggc gag atg ggc gtc        2160
Asn Val Thr Lys Cys Thr Gly Tyr Ser Met Leu Gly Glu Met Gly Val
705             710             715                 720

cac cgc ttc acc ttt gag ctc tac gtc gat gat gtg ctc ttt tac aag        2208
His Arg Phe Thr Phe Glu Leu Tyr Val Asp Asp Val Leu Phe Tyr Lys
                725             730             735

ggc tcg acc tcg ttc ggc tgg ttc gtg ccc gag gtc ttt gcc gcc cag        2256
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42

```
Gly Ser Thr Ser Phe Gly Trp Phe Val Pro Glu Val Phe Ala Ala Gln
        740             745             750

gcc ggc ctc gac aac ggc cgc aag tcg gag ccc tgg ttc att gag aac    2304
Ala Gly Leu Asp Asn Gly Arg Lys Ser Glu Pro Trp Phe Ile Glu Asn
        755             760             765

aag gtt ccg gcc tcg cag gtc tcc tcc ttt gac gtg cgc ccc aac ggc    2352
Lys Val Pro Ala Ser Gln Val Ser Ser Phe Asp Val Arg Pro Asn Gly
    770             775             780

agc ggc cgc acc gcc atc ttc gcc aac gcc ccc agc ggc gcc cag ctc    2400
Ser Gly Arg Thr Ala Ile Phe Ala Asn Ala Pro Ser Gly Ala Gln Leu
785             790             795             800

aac cgc cgc acg gac cag ggc cag tac ctc gac gcc gtc gac att gtc    2448
Asn Arg Arg Thr Asp Gln Gly Gln Tyr Leu Asp Ala Val Asp Ile Val
            805             810             815

tcc ggc agc ggc aag aag agc ctc ggc tac gcc cac ggt tcc aag acg    2496
Ser Gly Ser Gly Lys Lys Ser Leu Gly Tyr Ala His Gly Ser Lys Thr
        820             825             830

gtc aac ccg aac gac tgg ttc ttc tcg tgc cac ttt tgg ttt gac tcg    2544
Val Asn Pro Asn Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp Ser
        835             840             845

gtc atg ccc gga agt ctc ggt gtc gag tcc atg ttc cag ctc gtc gag    2592
Val Met Pro Gly Ser Leu Gly Val Glu Ser Met Phe Gln Leu Val Glu
    850             855             860

gcc atc gcc gcc cac gag gat ctc gct ggc aaa gca cgg cat tgc caa    2640
Ala Ile Ala Ala His Glu Asp Leu Ala Gly Lys Ala Arg His Cys Gln
865             870             875             880

ccc cac ctt tgt gca cgc ccc cgg gca aga tca agc tgg aag tac cgc    2688
Pro His Leu Cys Ala Arg Pro Arg Ala Arg Ser Ser Trp Lys Tyr Arg
            885             890             895

ggc cag ctc acg ccc aag agc aag aag atg gac tcg gag gtc cac atc    2736
Gly Gln Leu Thr Pro Lys Ser Lys Lys Met Asp Ser Glu Val His Ile
        900             905             910

gtg tcc gtg gac gcc cac gac ggc gtt gtc gac ctc gtc gcc gac ggc    2784
Val Ser Val Asp Ala His Asp Gly Val Val Asp Leu Val Ala Asp Gly
        915             920             925

ttc ctc tgg gcc gac agc ctc cgc gtc tac tcg gtg agc aac att cgc    2832
Phe Leu Trp Ala Asp Ser Leu Arg Val Tyr Ser Val Ser Asn Ile Arg
    930             935             940

gtg cgc atc gcc tcc ggt gag gcc cct gcc gcc gcc tcc tcc gcc gcc    2880
Val Arg Ile Ala Ser Gly Glu Ala Pro Ala Ala Ala Ser Ser Ala Ala
945             950             955             960

tct gtg ggc tcc tcg gct tcg tcc gtc gag cgc acg cgc tcg agc ccc    2928
Ser Val Gly Ser Ser Ala Ser Ser Val Glu Arg Thr Arg Ser Ser Pro
            965             970             975

gct gtc gcc tcc ggc ccg gcc cag acc atc gac ctc aag cag ctc aag    2976
Ala Val Ala Ser Gly Pro Ala Gln Thr Ile Asp Leu Lys Gln Leu Lys
            980             985             990

acc gag ctc ctc gag ctc gat gcc  ccg ctc tac ctc tcg  cag gac ccg    3024
Thr Glu Leu Leu Glu Leu Asp Ala  Pro Leu Tyr Leu Ser  Gln Asp Pro
        995             1000            1005

acc agc  ggc cag ctc aag aag  cac acc gac gtg gcc  tcc ggc cag        3069
```

43

```
Thr Ser Gly Gln Leu Lys Lys  His Thr Asp Val Ala  Ser Gly Gln
    1010              1015              1020

gcc acc atc gtg cag ccc tgc  acg ctc ggc gac ctc  ggt gac cgc        3114
Ala Thr Ile Val Gln Pro Cys  Thr Leu Gly Asp Leu  Gly Asp Arg
    1025              1030              1035

tcc ttc atg gag acc tac ggc  gtc gtc gcc ccg ctg  tac acg ggc        3159
Ser Phe Met Glu Thr Tyr Gly  Val Val Ala Pro Leu  Tyr Thr Gly
    1040              1045              1050

gcc atg gcc aag ggc att gcc  tcg gcg gac ctc gtc  atc gcc gcc        3204
Ala Met Ala Lys Gly Ile Ala  Ser Ala Asp Leu Val  Ile Ala Ala
    1055              1060              1065

ggc aag cgc aag atc ctc ggc  tcc ttt ggc gcc ggc  ggc ctc ccc        3249
Gly Lys Arg Lys Ile Leu Gly  Ser Phe Gly Ala Gly  Gly Leu Pro
    1070              1075              1080

atg cac cac gtg cgc gcc gcc  ctc gag aag atc cag  gcc gcc ctg        3294
Met His His Val Arg Ala Ala  Leu Glu Lys Ile Gln  Ala Ala Leu
    1085              1090              1095

cct cag ggc ccc tac gcc gtc  aac ctc atc cac tcg  cct ttt gac        3339
Pro Gln Gly Pro Tyr Ala Val  Asn Leu Ile His Ser  Pro Phe Asp
    1100              1105              1110

agc aac ctc gag aag ggc aac  gtc gat ctc ttc ctc  gag aag ggc        3384
Ser Asn Leu Glu Lys Gly Asn  Val Asp Leu Phe Leu  Glu Lys Gly
    1115              1120              1125

gtc act gtg gtg gag gcc tcg  gca ttc atg acc ctc  acc ccg cag        3429
Val Thr Val Val Glu Ala Ser  Ala Phe Met Thr Leu  Thr Pro Gln
    1130              1135              1140

gtc gtg cgc tac cgc gcc gcc  ggc ctc tcg cgc aac  gcc gac ggt        3474
Val Val Arg Tyr Arg Ala Ala  Gly Leu Ser Arg Asn  Ala Asp Gly
    1145              1150              1155

tcg gtc aac atc cgc aac cgc  atc atc ggc aag gtc  tcg cgc acc        3519
Ser Val Asn Ile Arg Asn Arg  Ile Ile Gly Lys Val  Ser Arg Thr
    1160              1165              1170

gag ctc gcc gag atg ttc atc  cgc ccg gcc ccg gag  cac ctc ctc        3564
Glu Leu Ala Glu Met Phe Ile  Arg Pro Ala Pro Glu  His Leu Leu
    1175              1180              1185

gag aag ctc atc gcc tcg ggc  gag atc acc cag gag  cag gcc gag        3609
Glu Lys Leu Ile Ala Ser Gly  Glu Ile Thr Gln Glu  Gln Ala Glu
    1190              1195              1200

ctc gcg cgc cgc gtt ccc gtc  gcc gac gat atc gct  gtc gag gct        3654
Leu Ala Arg Arg Val Pro Val  Ala Asp Asp Ile Ala  Val Glu Ala
    1205              1210              1215

gac tcg ggc ggc cac acc gac  aac cgc ccc atc cac  gtc atc ctc        3699
Asp Ser Gly Gly His Thr Asp  Asn Arg Pro Ile His  Val Ile Leu
    1220              1225              1230

ccg ctc atc atc aac ctc cgc  aac cgc ctg cac cgc  gag tgc ggc        3744
Pro Leu Ile Ile Asn Leu Arg  Asn Arg Leu His Arg  Glu Cys Gly
    1235              1240              1245

tac ccc gcg cac ctc cgc gtc  cgc gtt ggc gcc ggc  ggt ggc gtc        3789
Tyr Pro Ala His Leu Arg Val  Arg Val Gly Ala Gly  Gly Gly Val
    1250              1255              1260

ggc tgc ccg cag gcc gcc gcc  gcc gcg ctc acc atg  ggc gcc gcc        3834
```

44

```
Gly Cys Pro Gln Ala Ala Ala  Ala Ala Leu Thr Met  Gly Ala Ala
    1265             1270                  1275

ttc atc gtc acc ggc act gtc  aac cag gtc gcc aag  cag tcc ggc      3879
Phe Ile Val Thr Gly Thr Val  Asn Gln Val Ala Lys  Gln Ser Gly
    1280             1285                  1290

acc tgc gac aac gtg cgc aag  cag ctc tcg cag gcc  acc tac tcg      3924
Thr Cys Asp Asn Val Arg Lys  Gln Leu Ser Gln Ala  Thr Tyr Ser
    1295             1300                  1305

gat atc tgc atg gcc ccg gcc  gcc gac atg ttc gag  gag ggc gtc      3969
Asp Ile Cys Met Ala Pro Ala  Ala Asp Met Phe Glu  Glu Gly Val
    1310             1315                  1320

aag ctc cag gtc ctc aag aag  gga acc atg ttc ccc  tcg cgc gcc      4014
Lys Leu Gln Val Leu Lys Lys  Gly Thr Met Phe Pro  Ser Arg Ala
    1325             1330                  1335

aac aag ctc tac gag ctc ttt  tgc aag tac gac tcc  ttc gac tcc      4059
Asn Lys Leu Tyr Glu Leu Phe  Cys Lys Tyr Asp Ser  Phe Asp Ser
    1340             1345                  1350

atg cct cct gcc gag ctc gag  cgc atc gag aag cgt  atc ttc aag      4104
Met Pro Pro Ala Glu Leu Glu  Arg Ile Glu Lys Arg  Ile Phe Lys
    1355             1360                  1365

cgc gca ctc cag gag gtc tgg  gag gag acc aag gac  ttt tac att      4149
Arg Ala Leu Gln Glu Val Trp  Glu Glu Thr Lys Asp  Phe Tyr Ile
    1370             1375                  1380

aac ggt ctc aag aac ccg gag  aag atc cag cgc gcc  gag cac gac      4194
Asn Gly Leu Lys Asn Pro Glu  Lys Ile Gln Arg Ala  Glu His Asp
    1385             1390                  1395

ccc aag ctc aag atg tcg ctc  tgc ttc cgc tgg tac  ctt ggt ctt      4239
Pro Lys Leu Lys Met Ser Leu  Cys Phe Arg Trp Tyr  Leu Gly Leu
    1400             1405                  1410

gcc agc cgc tgg gcc aac atg  ggc gcc ccg gac cgc  gtc atg gac      4284
Ala Ser Arg Trp Ala Asn Met  Gly Ala Pro Asp Arg  Val Met Asp
    1415             1420                  1425

tac cag gtc tgg tgt ggc ccg  gcc att ggc gcc ttc  aac gac ttc      4329
Tyr Gln Val Trp Cys Gly Pro  Ala Ile Gly Ala Phe  Asn Asp Phe
    1430             1435                  1440

atc aag ggc acc tac ctc gac  ccc gct gtc tcc aac  gag tac ccc      4374
Ile Lys Gly Thr Tyr Leu Asp  Pro Ala Val Ser Asn  Glu Tyr Pro
    1445             1450                  1455

tgt gtc gtc cag atc aac ctg  caa atc ctc cgt ggt  gcc tgc tac      4419
Cys Val Val Gln Ile Asn Leu  Gln Ile Leu Arg Gly  Ala Cys Tyr
    1460             1465                  1470

ctg cgc cgt ctc aac gcc ctg  cgc aac gac ccg cgc  att gac ctc      4464
Leu Arg Arg Leu Asn Ala Leu  Arg Asn Asp Pro Arg  Ile Asp Leu
    1475             1480                  1485

gag acc gag gat gct gcc ttt  gtc tac gag ccc acc  aac gcg ctc      4509
Glu Thr Glu Asp Ala Ala Phe  Val Tyr Glu Pro Thr  Asn Ala Leu
    1490             1495                  1500
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<212> PRT
<213> Schizochytrium sp.

45

<400> 6

Met Ala Leu Arg Val Lys Thr Asn Lys Lys Pro Cys Trp Glu Met Thr
1   5   10   15

Lys Glu Glu Leu Thr Ser Gly Lys Thr Glu Val Phe Asn Tyr Glu Glu
            20   25   30

Leu Leu Glu Phe Ala Glu Gly Asp Ile Ala Lys Val Phe Gly Pro Glu
            35   40   45

Phe Ala Val Ile Asp Lys Tyr Pro Arg Arg Val Arg Leu Pro Ala Arg
        50   55   60

Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Asn
65   70   75   80

Asn Tyr Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Leu Pro Val
            85   90   95

Asn Gly Glu Leu Ser Glu Gly Gly Asp Cys Pro Trp Ala Val Leu Val
            100   105   110

Glu Ser Gly Gln Cys Asp Leu Met Leu Ile Ser Tyr Met Gly Ile Asp
            115   120   125

Phe Gln Asn Gln Gly Asp Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu
        130   135   140

Thr Phe Tyr Gly Val Ala His Glu Gly Glu Thr Leu Glu Tyr Asp Ile
145   150   155   160

Arg Val Thr Gly Phe Ala Lys Arg Leu Asp Gly Gly Ile Ser Met Phe
            165   170   175

Phe Phe Glu Tyr Asp Cys Tyr Val Asn Gly Arg Leu Leu Ile Glu Met
            180   185   190

Arg Asp Gly Cys Ala Gly Phe Phe Thr Asn Glu Glu Leu Asp Ala Gly
            195   200   205

Lys Gly Val Val Phe Thr Arg Gly Asp Leu Ala Ala Arg Ala Lys Ile
    210   215   220

Pro Lys Gln Asp Val Ser Pro Tyr Ala Val Ala Pro Cys Leu His Lys
225   230   235   240

Thr Lys Leu Asn Glu Lys Glu Met Gln Thr Leu Val Asp Lys Asp Trp
            245   250   255

Ala Ser Val Phe Gly Ser Lys Asn Gly Met Pro Glu Ile Asn Tyr Lys
            260   265   270

46

```
Leu Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr Ser Ile Asp
    275                 280                 285

His Lys Gly Gly Val Tyr Gly Leu Gly Gln Leu Val Gly Glu Lys Ile
    290                 295                 300

Leu Glu Arg Asp His Trp Tyr Phe Pro Cys His Phe Val Lys Asp Gln
305                 310                 315                 320

Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Met Leu Lys
            325                 330                 335

Met Tyr Met Ile Trp Leu Gly Leu His Leu Thr Thr Gly Pro Phe Asp
            340                 345                 350

Phe Arg Pro Val Asn Gly His Pro Asn Lys Val Arg Cys Arg Gly Gln
    355                 360                 365

Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Glu
    370                 375                 380

Met Gly Phe Asp Glu Asp Asn Asp Pro Tyr Ala Ile Ala Asp Val Asn
385                 390                 395                 400

Ile Ile Asp Val Asp Phe Glu Lys Gly Gln Asp Phe Ser Leu Asp Arg
            405                 410                 415

Ile Ser Asp Tyr Gly Lys Gly Asp Leu Asn Lys Lys Ile Val Val Asp
            420                 425                 430

Phe Lys Gly Ile Ala Leu Lys Met Gln Lys Arg Ser Thr Asn Lys Asn
            435                 440                 445

Pro Ser Lys Val Gln Pro Val Phe Ala Asn Gly Ala Ala Thr Val Gly
    450                 455                 460

Pro Glu Ala Ser Lys Ala Ser Ser Gly Ala Ser Ala Ser Ala Ser Ala
465                 470                 475                 480

Ala Pro Ala Lys Pro Ala Phe Ser Ala Asp Val Leu Ala Pro Lys Pro
            485                 490                 495

Val Ala Leu Pro Glu His Ile Leu Lys Gly Asp Ala Leu Ala Pro Lys
            500                 505                 510

Glu Met Ser Trp His Pro Met Ala Arg Ile Pro Gly Asn Pro Thr Pro
        515                 520                 525

Ser Phe Ala Pro Ser Ala Tyr Lys Pro Arg Asn Ile Ala Phe Thr Pro
    530                 535                 540
```

47

Phe Pro Gly Asn Pro Asn Asp Asn Asp His Thr Pro Gly Lys Met Pro
545   550   555   560

Leu Thr Trp Phe Asn Met Ala Glu Phe Met Ala Gly Lys Val Ser Met
                565   570   575

Cys Leu Gly Pro Glu Phe Ala Lys Phe Asp Asp Ser Asn Thr Ser Arg
            580   585   590

Ser Pro Ala Trp Asp Leu Ala Leu Val Thr Arg Ala Val Ser Val Ser
        595   600   605

Asp Leu Lys His Val Asn Tyr Arg Asn Ile Asp Leu Asp Pro Ser Lys
    610   615   620

Gly Thr Met Val Gly Glu Phe Asp Cys Pro Ala Asp Ala Trp Phe Tyr
625   630   635   640

Lys Gly Ala Cys Asn Asp Ala His Met Pro Tyr Ser Ile Leu Met Glu
            645   650   655

Ile Ala Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu Lys Ala Pro
            660   665   670

Leu Thr Met Glu Lys Asp Asp Ile Leu Phe Arg Asn Leu Asp Ala Asn
            675   680   685

Ala Glu Phe Val Arg Ala Asp Leu Asp Tyr Arg Gly Lys Thr Ile Arg
    690   695   700

Asn Val Thr Lys Cys Thr Gly Tyr Ser Met Leu Gly Glu Met Gly Val
705   710   715   720

His Arg Phe Thr Phe Glu Leu Tyr Val Asp Asp Val Leu Phe Tyr Lys
            725   730   735

Gly Ser Thr Ser Phe Gly Trp Phe Val Pro Glu Val Phe Ala Ala Gln
            740   745   750

Ala Gly Leu Asp Asn Gly Arg Lys Ser Glu Pro Trp Phe Ile Glu Asn
            755   760   765

Lys Val Pro Ala Ser Gln Val Ser Ser Phe Asp Val Arg Pro Asn Gly
    770   775   780

Ser Gly Arg Thr Ala Ile Phe Ala Asn Ala Pro Ser Gly Ala Gln Leu
785   790   795   800

Asn Arg Arg Thr Asp Gln Gly Gln Tyr Leu Asp Ala Val Asp Ile Val
            805   810   815

48

```
Ser Gly Ser Gly Lys Lys Ser Leu Gly Tyr Ala His Gly Ser Lys Thr
        820             825             830

Val Asn Pro Asn Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp Ser
        835             840             845

Val Met Pro Gly Ser Leu Gly Val Glu Ser Met Phe Gln Leu Val Glu
    850             855             860

Ala Ile Ala Ala His Glu Asp Leu Ala Gly Lys Ala Arg His Cys Gln
865             870             875             880

Pro His Leu Cys Ala Arg Pro Arg Ala Arg Ser Ser Trp Lys Tyr Arg
            885             890             895

Gly Gln Leu Thr Pro Lys Ser Lys Lys Met Asp Ser Glu Val His Ile
            900             905             910

Val Ser Val Asp Ala His Asp Gly Val Val Asp Leu Val Ala Asp Gly
        915             920             925

Phe Leu Trp Ala Asp Ser Leu Arg Val Tyr Ser Val Ser Asn Ile Arg
    930             935             940

Val Arg Ile Ala Ser Gly Glu Ala Pro Ala Ala Ala Ser Ser Ala Ala
945             950             955             960

Ser Val Gly Ser Ser Ala Ser Ser Val Glu Arg Thr Arg Ser Ser Pro
            965             970             975

Ala Val Ala Ser Gly Pro Ala Gln Thr Ile Asp Leu Lys Gln Leu Lys
            980             985             990

Thr Glu Leu Leu Glu Leu Asp Ala Pro Leu Tyr Leu Ser Gln Asp Pro
        995             1000            1005

Thr Ser Gly Gln Leu Lys Lys His Thr Asp Val Ala Ser Gly Gln
    1010            1015            1020

Ala Thr Ile Val Gln Pro Cys Thr Leu Gly Asp Leu Gly Asp Arg
    1025            1030            1035

Ser Phe Met Glu Thr Tyr Gly Val Val Ala Pro Leu Tyr Thr Gly
    1040            1045            1050

Ala Met Ala Lys Gly Ile Ala Ser Ala Asp Leu Val Ile Ala Ala
    1055            1060            1065

Gly Lys Arg Lys Ile Leu Gly Ser Phe Gly Ala Gly Gly Leu Pro
    1070            1075            1080
```

49

```
Met His  His Val Arg Ala Ala  Leu Glu Lys Ile Gln  Ala Ala Leu
    1085              1090          1095

Pro Gln  Gly Pro Tyr Ala Val  Asn Leu Ile His Ser  Pro Phe Asp
    1100              1105          1110

Ser Asn  Leu Glu Lys Gly Asn  Val Asp Leu Phe Leu  Glu Lys Gly
    1115              1120          1125

Val Thr  Val Val Glu Ala Ser  Ala Phe Met Thr Leu  Thr Pro Gln
    1130              1135          1140

Val Val  Arg Tyr Arg Ala Ala  Gly Leu Ser Arg Asn  Ala Asp Gly
    1145              1150          1155

Ser Val  Asn Ile Arg Asn Arg  Ile Ile Gly Lys Val  Ser Arg Thr
    1160              1165          1170

Glu Leu  Ala Glu Met Phe Ile  Arg Pro Ala Pro Glu  His Leu Leu
    1175              1180          1185

Glu Lys  Leu Ile Ala Ser Gly  Glu Ile Thr Gln Glu  Gln Ala Glu
    1190              1195          1200

Leu Ala  Arg Arg Val Pro Val  Ala Asp Asp Ile Ala  Val Glu Ala
    1205              1210          1215

Asp Ser  Gly Gly His Thr Asp  Asn Arg Pro Ile His  Val Ile Leu
    1220              1225          1230

Pro Leu  Ile Ile Asn Leu Arg  Asn Arg Leu His Arg  Glu Cys Gly
    1235              1240          1245

Tyr Pro  Ala His Leu Arg Val  Arg Val Gly Ala Gly  Gly Gly Val
    1250              1255          1260

Gly Cys  Pro Gln Ala Ala Ala  Ala Ala Leu Thr Met  Gly Ala Ala
    1265              1270          1275

Phe Ile  Val Thr Gly Thr Val  Asn Gln Val Ala Lys  Gln Ser Gly
    1280              1285          1290

Thr Cys  Asp Asn Val Arg Lys  Gln Leu Ser Gln Ala  Thr Tyr Ser
    1295              1300          1305

Asp Ile  Cys Met Ala Pro Ala  Ala Asp Met Phe Glu  Glu Gly Val
    1310              1315          1320

Lys Leu  Gln Val Leu Lys Lys  Gly Thr Met Phe Pro  Ser Arg Ala
    1325              1330          1335
```

50

```
Asn Lys  Leu Tyr Glu Leu Phe  Cys Lys Tyr Asp Ser  Phe Asp Ser
    1340             1345             1350


Met Pro  Pro Ala Glu Leu Glu  Arg Ile Glu Lys Arg  Ile Phe Lys
    1355             1360             1365


Arg Ala  Leu Gln Glu Val Trp  Glu Glu Thr Lys Asp  Phe Tyr Ile
    1370             1375             1380


Asn Gly  Leu Lys Asn Pro Glu  Lys Ile Gln Arg Ala  Glu His Asp
    1385             1390             1395


Pro Lys  Leu Lys Met Ser Leu  Cys Phe Arg Trp Tyr  Leu Gly Leu
    1400             1405             1410


Ala Ser  Arg Trp Ala Asn Met  Gly Ala Pro Asp Arg  Val Met Asp
    1415             1420             1425


Tyr Gln  Val Trp Cys Gly Pro  Ala Ile Gly Ala Phe  Asn Asp Phe
    1430             1435             1440


Ile Lys  Gly Thr Tyr Leu Asp  Pro Ala Val Ser Asn  Glu Tyr Pro
    1445             1450             1455


Cys Val  Val Gln Ile Asn Leu  Gln Ile Leu Arg Gly  Ala Cys Tyr
    1460             1465             1470


Leu Arg  Arg Leu Asn Ala Leu  Arg Asn Asp Pro Arg  Ile Asp Leu
    1475             1480             1485


Glu Thr  Glu Asp Ala Ala Phe  Val Tyr Glu Pro Thr  Asn Ala Leu
    1490             1495             1500



<210>   7
<211>   600
<212>   DNA
<213>   Schizochytrium sp.


<220>
<221>   CDS
<222>   (1)..(600)

<400>   7
atg gcg gcc cgt ctg cag gag caa aag gga ggc gag atg gat acc cgc      48
Met Ala Ala Arg Leu Gln Glu Gln Lys Gly Gly Glu Met Asp Thr Arg
1               5                   10                  15

att gcc atc atc ggc atg tcg gcc atc ctc ccc tgc ggc acg acc gtg      96
Ile Ala Ile Ile Gly Met Ser Ala Ile Leu Pro Cys Gly Thr Thr Val
                20                  25                  30

cgc gag tcg tgg gag acc atc cgc gcc ggc atc gac tgc ctg tcg gat     144
Arg Glu Ser Trp Glu Thr Ile Arg Ala Gly Ile Asp Cys Leu Ser Asp
            35                  40                  45

ctc ccc gag gac cgc gtc gac gtg acg gcg tac ttt gac ccc gtc aag     192
```

51

```
Leu Pro Glu Asp Arg Val Asp Val Thr Ala Tyr Phe Asp Pro Val Lys
    50                  55                  60

acc acc aag gac aag atc tac tgc aag cgc ggt ggc ttc att ccc gag          240
Thr Thr Lys Asp Lys Ile Tyr Cys Lys Arg Gly Gly Phe Ile Pro Glu
65                  70                  75                  80

tac gac ttt gac gcc cgc gag ttc gga ctc aac atg ttc cag atg gag          288
Tyr Asp Phe Asp Ala Arg Glu Phe Gly Leu Asn Met Phe Gln Met Glu
                85                  90                  95

gac tcg gac gca aac cag acc atc tcg ctt ctc aag gtc aag gag gcc          336
Asp Ser Asp Ala Asn Gln Thr Ile Ser Leu Leu Lys Val Lys Glu Ala
                100                 105                 110

ctc cag gac gcc ggc atc gac gcc ctc ggc aag gaa aag aag aac atc          384
Leu Gln Asp Ala Gly Ile Asp Ala Leu Gly Lys Glu Lys Lys Asn Ile
            115                 120                 125

ggc tgc gtg ctc ggc att ggc ggc ggc caa aag tcc agc cac gag ttc          432
Gly Cys Val Leu Gly Ile Gly Gly Gly Gln Lys Ser Ser His Glu Phe
    130                 135                 140

tac tcg cgc ctt aat tat gtt gtc gtg gag aag gtc ctc cgc aag atg          480
Tyr Ser Arg Leu Asn Tyr Val Val Val Glu Lys Val Leu Arg Lys Met
145                 150                 155                 160

ggc atg ccc gag gag gac gtc aag gtc gcc gtc gaa aag tac aag gcc          528
Gly Met Pro Glu Glu Asp Val Lys Val Ala Val Glu Lys Tyr Lys Ala
                165                 170                 175

aac ttc ccc gag tgg cgc ctc gac tcc ttc cct ggc ttc ctc ggc aac          576
Asn Phe Pro Glu Trp Arg Leu Asp Ser Phe Pro Gly Phe Leu Gly Asn
                180                 185                 190

gtc acc gcc ggt cgc tgc acc aac                                          600
Val Thr Ala Gly Arg Cys Thr Asn
            195                 200


<210>   8
<211>   200
<212>   PRT
<213>   Schizochytrium sp.

<400>   8

Met Ala Ala Arg Leu Gln Glu Gln Lys Gly Gly Glu Met Asp Thr Arg
1                   5                   10                  15


Ile Ala Ile Ile Gly Met Ser Ala Ile Leu Pro Cys Gly Thr Thr Val
                20                  25                  30


Arg Glu Ser Trp Glu Thr Ile Arg Ala Gly Ile Asp Cys Leu Ser Asp
            35                  40                  45


Leu Pro Glu Asp Arg Val Asp Val Thr Ala Tyr Phe Asp Pro Val Lys
    50                  55                  60


Thr Thr Lys Asp Lys Ile Tyr Cys Lys Arg Gly Gly Phe Ile Pro Glu
65                  70                  75                  80


Tyr Asp Phe Asp Ala Arg Glu Phe Gly Leu Asn Met Phe Gln Met Glu
```
52

Asp Ser Asp Ala Asn Gln Thr Ile Ser Leu Leu Lys Val Lys Glu Ala
        100   105   110

Leu Gln Asp Ala Gly Ile Asp Ala Leu Gly Lys Glu Lys Lys Asn Ile
        115   120   125

Gly Cys Val Leu Gly Ile Gly Gly Gly Gln Lys Ser Ser His Glu Phe
    130   135   140

Tyr Ser Arg Leu Asn Tyr Val Val Val Glu Lys Val Leu Arg Lys Met
145   150   155   160

Gly Met Pro Glu Glu Asp Val Lys Val Ala Val Glu Lys Tyr Lys Ala
                165   170   175

Asn Phe Pro Glu Trp Arg Leu Asp Ser Phe Pro Gly Phe Leu Gly Asn
                180   185   190

Val Thr Ala Gly Arg Cys Thr Asn
        195   200

<210>   9
<211>   1278
<212>   DNA
<213>   Schizochytrium sp.

<220>
<221>   CDS
<222>   (1)..(1278)

<400>   9
gat gtc acc aag gag gcc tgg cgc ctc ccc cgc gag ggc gtc agc ttc   48
Asp Val Thr Lys Glu Ala Trp Arg Leu Pro Arg Glu Gly Val Ser Phe
1   5   10   15

cgc gcc aag ggc atc gcc acc aac ggc gct gtc gcc gcg ctc ttc tcc   96
Arg Ala Lys Gly Ile Ala Thr Asn Gly Ala Val Ala Ala Leu Phe Ser
            20   25   30

ggc cag ggc gcg cag tac acg cac atg ttt agc gag gtg gcc atg aac   144
Gly Gln Gly Ala Gln Tyr Thr His Met Phe Ser Glu Val Ala Met Asn
        35   40   45

tgg ccc cag ttc cgc cag agc att gcc gcc atg gac gcc gcc cag tcc   192
Trp Pro Gln Phe Arg Gln Ser Ile Ala Ala Met Asp Ala Ala Gln Ser
    50   55   60

aag gtc gct gga agc gac aag gac ttt gag cgc gtc tcc cag gtc ctc   240
Lys Val Ala Gly Ser Asp Lys Asp Phe Glu Arg Val Ser Gln Val Leu
65   70   75   80

tac ccg cgc aag ccg tac gag cgt gag ccc gag cag aac ccc aag aag   288
Tyr Pro Arg Lys Pro Tyr Glu Arg Glu Pro Glu Gln Asn Pro Lys Lys
                85   90   95

atc tcc ctc acc gcc tac tcg cag ccc tcg acc ctg gcc tgc gct ctc   336
Ile Ser Leu Thr Ala Tyr Ser Gln Pro Ser Thr Leu Ala Cys Ala Leu

```
ggt gcc ttt gag atc ttc aag gag gcc ggc ttc acc ccg gac ttt gcc    384
Gly Ala Phe Glu Ile Phe Lys Glu Ala Gly Phe Thr Pro Asp Phe Ala
        115                 120                 125

gcc ggc cat tcg ctc ggt gag ttc gcc gcc ctc tac gcc gcg ggc tgc    432
Ala Gly His Ser Leu Gly Glu Phe Ala Ala Leu Tyr Ala Ala Gly Cys
        130                 135                 140

gtc gac cgc gac gag ctc ttt gag ctt gtc tgc cgc cgc gcc cgc atc    480
Val Asp Arg Asp Glu Leu Phe Glu Leu Val Cys Arg Arg Ala Arg Ile
145                 150                 155                 160

atg ggc ggc aag gac gca ccg gcc acc ccc aag gga tgc atg gcc gcc    528
Met Gly Gly Lys Asp Ala Pro Ala Thr Pro Lys Gly Cys Met Ala Ala
                165                 170                 175

gtc att ggc ccc aac gcc gag aac atc aag gtc cag gcc gcc aac gtc    576
Val Ile Gly Pro Asn Ala Glu Asn Ile Lys Val Gln Ala Ala Asn Val
            180                 185                 190

tgg ctc ggc aac tcc aac tcg cct tcg cag acc gtc atc acc ggc tcc    624
Trp Leu Gly Asn Ser Asn Ser Pro Ser Gln Thr Val Ile Thr Gly Ser
            195                 200                 205

gtc gaa ggt atc cag gcc gag agc gcc cgc ctc cag aag gag ggc ttc    672
Val Glu Gly Ile Gln Ala Glu Ser Ala Arg Leu Gln Lys Glu Gly Phe
        210                 215                 220

cgc gtc gtg cct ctt gcc tgc gag agc gcc ttc cac tcg ccc cag atg    720
Arg Val Val Pro Leu Ala Cys Glu Ser Ala Phe His Ser Pro Gln Met
225                 230                 235                 240

gag aac gcc tcg tcg gcc ttc aag gac gtc atc tcc aag gtc tcc ttc    768
Glu Asn Ala Ser Ser Ala Phe Lys Asp Val Ile Ser Lys Val Ser Phe
            245                 250                 255

cgc acc ccc aag gcc gag acc aag ctc ttc agc aac gtc tct ggc gag    816
Arg Thr Pro Lys Ala Glu Thr Lys Leu Phe Ser Asn Val Ser Gly Glu
            260                 265                 270

acc tac ccc acg gac gcc cgc gag atg ctt acg cag cac atg acc agc    864
Thr Tyr Pro Thr Asp Ala Arg Glu Met Leu Thr Gln His Met Thr Ser
            275                 280                 285

agc gtc aag ttc ctc acc cag gtc cgc aac atg cac cag gcc ggt gcg    912
Ser Val Lys Phe Leu Thr Gln Val Arg Asn Met His Gln Ala Gly Ala
        290                 295                 300

cgc atc ttt gtc gag ttc gga ccc aag cag gtg ctc tcc aag ctt gtc    960
Arg Ile Phe Val Glu Phe Gly Pro Lys Gln Val Leu Ser Lys Leu Val
305                 310                 315                 320

tcc gag acc ctc aag gat gac ccc tcg gtt gtc acc gtc tct gtc aac   1008
Ser Glu Thr Leu Lys Asp Asp Pro Ser Val Val Thr Val Ser Val Asn
                325                 330                 335

ccg gcc tcg ggc acg gat tcg gac atc cag ctc cgc gac gcg gcc gtc   1056
Pro Ala Ser Gly Thr Asp Ser Asp Ile Gln Leu Arg Asp Ala Ala Val
                340                 345                 350

cag ctc gtt gtc gct ggc gtc aac ctt cag ggc ttt gac aag tgg gac   1104
Gln Leu Val Val Ala Gly Val Asn Leu Gln Gly Phe Asp Lys Trp Asp
            355                 360                 365

gcc ccc gat gcc acc cgc atg cag gcc atc aag aag aag cgc act acc   1152
Ala Pro Asp Ala Thr Arg Met Gln Ala Ile Lys Lys Lys Arg Thr Thr
```

```
              370                 375                 380

ctc cgc ctt tcg gcc gcc acc tac gtc tcg gac aag acc aag aag gtc      1200
Leu Arg Leu Ser Ala Ala Thr Tyr Val Ser Asp Lys Thr Lys Lys Val
385                 390                 395                 400

cgc gac gcc gcc atg aac gat ggc cgc tgc gtc acc tac ctc aag ggc      1248
Arg Asp Ala Ala Met Asn Asp Gly Arg Cys Val Thr Tyr Leu Lys Gly
                405                 410                 415

gcc gca ccg ctc atc aag gcc ccg gag ccc                              1278
Ala Ala Pro Leu Ile Lys Ala Pro Glu Pro
                420                 425
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<210> 10
<211> 426
<212> PRT
<213> Schizochytrium sp.

<400> 10

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Asp Val Thr Lys Glu Ala Trp Arg Leu Pro Arg Glu Gly Val Ser Phe
1               5                   10                  15


Arg Ala Lys Gly Ile Ala Thr Asn Gly Ala Val Ala Ala Leu Phe Ser
            20                  25                  30


Gly Gln Gly Ala Gln Tyr Thr His Met Phe Ser Glu Val Ala Met Asn
            35                  40                  45


Trp Pro Gln Phe Arg Gln Ser Ile Ala Ala Met Asp Ala Ala Gln Ser
    50                  55                  60


Lys Val Ala Gly Ser Asp Lys Asp Phe Glu Arg Val Ser Gln Val Leu
65                  70                  75                  80


Tyr Pro Arg Lys Pro Tyr Glu Arg Glu Pro Glu Gln Asn Pro Lys Lys
                85                  90                  95


Ile Ser Leu Thr Ala Tyr Ser Gln Pro Ser Thr Leu Ala Cys Ala Leu
            100                 105                 110


Gly Ala Phe Glu Ile Phe Lys Glu Ala Gly Phe Thr Pro Asp Phe Ala
            115                 120                 125


Ala Gly His Ser Leu Gly Glu Phe Ala Ala Leu Tyr Ala Ala Gly Cys
    130                 135                 140


Val Asp Arg Asp Glu Leu Phe Glu Leu Val Cys Arg Arg Ala Arg Ile
145                 150                 155                 160


Met Gly Gly Lys Asp Ala Pro Ala Thr Pro Lys Gly Cys Met Ala Ala
                165                 170                 175


Val Ile Gly Pro Asn Ala Glu Asn Ile Lys Val Gln Ala Ala Asn Val
            180                 185                 190
```

55

Trp Leu Gly Asn Ser Asn Ser Pro Ser Gln Thr Val Ile Thr Gly Ser
        195   200   205

Val Glu Gly Ile Gln Ala Glu Ser Ala Arg Leu Gln Lys Glu Gly Phe
    210   215   220

Arg Val Val Pro Leu Ala Cys Glu Ser Ala Phe His Ser Pro Gln Met
225   230   235   240

Glu Asn Ala Ser Ser Ala Phe Lys Asp Val Ile Ser Lys Val Ser Phe
                245   250   255

Arg Thr Pro Lys Ala Glu Thr Lys Leu Phe Ser Asn Val Ser Gly Glu
            260   265   270

Thr Tyr Pro Thr Asp Ala Arg Glu Met Leu Thr Gln His Met Thr Ser
        275   280   285

Ser Val Lys Phe Leu Thr Gln Val Arg Asn Met His Gln Ala Gly Ala
    290   295   300

Arg Ile Phe Val Glu Phe Gly Pro Lys Gln Val Leu Ser Lys Leu Val
305   310   315   320

Ser Glu Thr Leu Lys Asp Asp Pro Ser Val Val Thr Val Ser Val Asn
                325   330   335

Pro Ala Ser Gly Thr Asp Ser Asp Ile Gln Leu Arg Asp Ala Ala Val
            340   345   350

Gln Leu Val Val Ala Gly Val Asn Leu Gln Gly Phe Asp Lys Trp Asp
        355   360   365

Ala Pro Asp Ala Thr Arg Met Gln Ala Ile Lys Lys Lys Arg Thr Thr
    370   375   380

Leu Arg Leu Ser Ala Ala Thr Tyr Val Ser Asp Lys Thr Lys Lys Val
385   390   395   400

Arg Asp Ala Ala Met Asn Asp Gly Arg Cys Val Thr Tyr Leu Lys Gly
            405   410   415

Ala Ala Pro Leu Ile Lys Ala Pro Glu Pro
            420   425

<210>   11
<211>   5
<212>   PRT
<213>   Schizochytrium sp.

<220>

56

<221> MISC_FEATURE
<222> (1)..(5)
<223> Xaa = any amino acid

<400> 11

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Gly His Ser Xaa Gly
1               5
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<210> 12
<211> 258
<212> DNA
<213> Schizochytrium sp.

<220>
<221> CDS
<222> (1)..(258)

<400> 12
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gct gtc tcg aac gag ctt ctt gag aag gcc gag act gtc gtc atg gag      48
Ala Val Ser Asn Glu Leu Leu Glu Lys Ala Glu Thr Val Val Met Glu
1               5                   10                  15

gtc ctc gcc gcc aag acc ggc tac gag acc gac atg atc gag gct gac      96
Val Leu Ala Ala Lys Thr Gly Tyr Glu Thr Asp Met Ile Glu Ala Asp
                20                  25                  30

atg gag ctc gag acc gag ctc ggc att gac tcc atc aag cgt gtc gag     144
Met Glu Leu Glu Thr Glu Leu Gly Ile Asp Ser Ile Lys Arg Val Glu
            35                  40                  45

atc ctc tcc gag gtc cag gcc atg ctc aat gtc gag gcc aag gat gtc     192
Ile Leu Ser Glu Val Gln Ala Met Leu Asn Val Glu Ala Lys Asp Val
    50                  55                  60

gat gcc ctc agc cgc act cgc act gtt ggt gag gtt gtc aac gcc atg     240
Asp Ala Leu Ser Arg Thr Arg Thr Val Gly Glu Val Val Asn Ala Met
65                  70                  75                  80

aag gcc gag atc gct ggc                                             258
Lys Ala Glu Ile Ala Gly
                85
```


<210> 13
<211> 86
<212> PRT
<213> Schizochytrium sp.

<400> 13

```
Ala Val Ser Asn Glu Leu Leu Glu Lys Ala Glu Thr Val Val Met Glu
1               5                   10                  15


Val Leu Ala Ala Lys Thr Gly Tyr Glu Thr Asp Met Ile Glu Ala Asp
                20                  25                  30


Met Glu Leu Glu Thr Glu Leu Gly Ile Asp Ser Ile Lys Arg Val Glu
            35                  40                  45


Ile Leu Ser Glu Val Gln Ala Met Leu Asn Val Glu Ala Lys Asp Val
    50                  55                  60
```

Asp Ala Leu Ser Arg Thr Arg Thr Val Gly Glu Val Val Asn Ala Met
65   70   75   80

Lys Ala Glu Ile Ala Gly
                85

<210> 14
<211> 5
<212> PRT
<213> Schizochytrium sp.

<400> 14

Leu Gly Ile Asp Ser
1   5

<210> 15
<211> 21
<212> PRT
<213> Schizochytrium sp.

<400> 15

Ala Pro Ala Pro Val Lys Ala Ala Ala Pro Ala Ala Pro Val Ala Ser
1   5   10   15

Ala Pro Ala Pro Ala
            20

<210> 16
<211> 3006
<212> DNA
<213> Schizochytrium sp.

<400> 16
gcccccgccc cggtcaaggc tgctgcgcct gccgcccccg ttgcctcggc ccctgccccg   60

gctgtctcga acgagcttct tgagaaggcc gagactgtcg tcatggaggt cctcgccgcc   120

aagaccggct acgagaccga catgatcgag gctgacatgg agctcgagac cgagctcggc   180

attgactcca tcaagcgtgt cgagatcctc tccgaggtcc aggccatgct caatgtcgag   240

gccaaggatg tcgatgccct cagccgcact cgcactgttg gtgaggttgt caacgccatg   300

aaggccgaga tcgctggcag ctctgccccg gcgcctgctg ccgctgctcc ggctccggcc   360

aaggctgccc ctgccgccgc tgcgcctgct gtctcgaacg agcttctcga gaaggccgag   420

accgtcgtca tggaggtcct cgccgccaag actggctacg agactgacat gatcgagtcc   480

gacatggagc tcgagactga gctcggcatt gactccatca agcgtgtcga gatcctctcc   540

gaggttcagg ccatgctcaa cgtcgaggcc aaggacgtcg acgctctcag ccgcactcgc   600

actgtgggtg aggtcgtcaa cgccatgaag gctgagatcg ctggtggctc tgccccggcg   660

cctgccgccg ctgccccagg tccggctgct gccgcccctg cgcctgccgc cgccgcccct   720

gctgtctcga acgagcttct tgagaaggcc gagaccgtcg tcatggaggt cctcgccgcc   780

aagactggct acgagactga catgatcgag tccgacatgg agctcgagac cgagctcggc   840

58

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attgactcca tcaagcgtgt cgagattctc tccgaggtcc aggccatgct caacgtcgag    900

gccaaggacg tcgacgctct cagccgcacc cgcactgttg gcgaggtcgt cgatgccatg    960

aaggccgaga tcgctggtgg ctctgccccg gcgcctgccg ccgctgctcc tgctccggct   1020

gctgccgccc ctgcgcctgc cgcccctgcg cctgctgtct cgagcgagct tctcgagaag   1080

gccgagactg tcgtcatgga ggtcctcgcc gccaagactg gctacgagac tgacatgatc   1140

gagtccgaca tggagctcga gaccgagctc ggcattgact ccatcaagcg tgtcgagatt   1200

ctctccgagg tccaggccat gctcaacgtc gaggccaagg acgtcgacgc tctcagccgc   1260

acccgcactg ttggcgaggt cgtcgatgcc atgaaggccg agatcgctgg tggctctgcc   1320

ccggcgcctg ccgccgctgc tcctgctccg gctgctgccg cccctgcgcc tgccgcccct   1380

gcgcctgccg cccctgcgcc tgctgtctcg agcgagcttc tcgagaaggc cgagactgtc   1440

gtcatggagg tcctcgccgc caagactggc tacgagactg acatgattga gtccgacatg   1500

gagctcgaga ccgagctcgg cattgactcc atcaagcgtg tcgagattct ctccgaggtt   1560

caggccatgc tcaacgtcga ggccaaggac gtcgacgctc tcagccgcac tcgcactgtt   1620

ggtgaggtcg tcgatgccat gaaggctgag atcgctggca gctccgcctc ggcgcctgcc   1680

gccgctgctc ctgctccggc tgctgccgct cctgcgcccg ctgccgccgc ccctgctgtc   1740

tcgaacgagc ttctcgagaa agccgagact gtcgtcatgg aggtcctcgc cgccaagact   1800

ggctacgaga ctgacatgat cgagtccgac atggagctcg agactgagct cggcattgac   1860

tccatcaagc gtgtcgagat cctctccgag gttcaggcca tgctcaacgt cgaggccaag   1920

gacgtcgatg ccctcagccg cacccgcact gttggcgagg ttgtcgatgc catgaaggcc   1980

gagatcgctg gtggctctgc cccggcgcct gccgccgctg cccctgctcc ggctgccgcc   2040

gcccctgctg tctcgaacga gcttctcgag aaggccgaga ctgtcgtcat ggaggtcctc   2100

gccgccaaga ctggctacga gaccgacatg atcgagtccg acatggagct cgagaccgag   2160

ctcggcattg actccatcaa gcgtgtcgag attctctccg aggttcaggc catgctcaac   2220

gtcgaggcca aggacgtcga tgctctcagc cgcactcgca ctgttggcga ggtcgtcgat   2280

gccatgaagg ctgagatcgc cggcagctcc gccccggcgc ctgccgccgc tgctcctgct   2340

ccggctgctg ccgctcctgc gcccgctgcc gctgcccctg ctgtctcgag cgagcttctc   2400

gagaaggccg agacgtcgt catggaggtc ctcgccgcca agactggcta cgagactgac   2460

atgattgagt ccgacatgga gctcgagact gagctcggca ttgactccat caagcgtgtc   2520

gagatcctct ccgaggttca ggccatgctc aacgtcgagg ccaaggacgt cgatgccctc   2580

agccgcaccc gcactgttgg cgaggttgtc gatgccatga aggccgagat cgctggtggc   2640

tctgccccgg cgcctgccgc cgctgcccct gctccggctg ccgccgcccc tgctgtctcg   2700

aacgagcttc ttgagaaggc cgagaccgtc gtcatggagg tcctcgccgc caagactggc   2760

tacgagaccg acatgatcga gtccgacatg gagctcgaga ccgagctcgg cattgactcc   2820

atcaagcgtg tcgagattct ctccgaggtt caggccatgc tcaacgtcga ggccaaggac   2880
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59

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gtcgacgctc tcagccgcac tcgcactgtt ggcgaggtcg tcgatgccat gaaggctgag    2940

atcgctggtg gctctgcccc ggcgcctgcc gccgctgctc ctgcctcggc tggcgccgcg    3000

cctgcg                                                               3006


<210>  17
<211>  2133
<212>  DNA
<213>  Schizochytrium sp.


<220>
<221>  CDS
<222>  (1)..(2133)

<400>  17
ttt ggc gct ctc ggc ggc ttc atc tcg cag cag gcg gag cgc ttc gag     48
Phe Gly Ala Leu Gly Gly Phe Ile Ser Gln Gln Ala Glu Arg Phe Glu
1               5                   10                  15

ccc gcc gaa atc ctc ggc ttc acg ctc atg tgc gcc aag ttc gcc aag     96
Pro Ala Glu Ile Leu Gly Phe Thr Leu Met Cys Ala Lys Phe Ala Lys
                20                  25                  30

gct tcc ctc tgc acg gct gtg gct ggc ggc cgc ccg gcc ttt atc ggt    144
Ala Ser Leu Cys Thr Ala Val Ala Gly Gly Arg Pro Ala Phe Ile Gly
            35                  40                  45

gtg gcg cgc ctt gac ggc cgc ctc gga ttc act tcg cag ggc act tct    192
Val Ala Arg Leu Asp Gly Arg Leu Gly Phe Thr Ser Gln Gly Thr Ser
        50                  55                  60

gac gcg ctc aag cgt gcc cag cgt ggt gcc atc ttt ggc ctc tgc aag    240
Asp Ala Leu Lys Arg Ala Gln Arg Gly Ala Ile Phe Gly Leu Cys Lys
65                  70                  75                  80

acc atc ggc ctc gag tgg tcc gag tct gac gtc ttt tcc cgc ggc gtg    288
Thr Ile Gly Leu Glu Trp Ser Glu Ser Asp Val Phe Ser Arg Gly Val
                85                  90                  95

gac att gct cag ggc atg cac ccc gag gat gcc gcc gtg gcg att gtg    336
Asp Ile Ala Gln Gly Met His Pro Glu Asp Ala Ala Val Ala Ile Val
                100                 105                 110

cgc gag atg gcg tgc gct gac att cgc att cgc gag gtc ggc att ggc    384
Arg Glu Met Ala Cys Ala Asp Ile Arg Ile Arg Glu Val Gly Ile Gly
            115                 120                 125

gca aac cag cag cgc tgc acg atc cgt gcc gcc aag ctc gag acc ggc    432
Ala Asn Gln Gln Arg Cys Thr Ile Arg Ala Ala Lys Leu Glu Thr Gly
        130                 135                 140

aac ccg cag cgc cag atc gcc aag gac gac gtg ctg ctc gtt tct ggc    480
Asn Pro Gln Arg Gln Ile Ala Lys Asp Asp Val Leu Leu Val Ser Gly
145                 150                 155                 160

ggc gct cgc ggc atc acg cct ctt tgc atc cgg gag atc acg cgc cag    528
Gly Ala Arg Gly Ile Thr Pro Leu Cys Ile Arg Glu Ile Thr Arg Gln
                165                 170                 175

atc gcg ggc ggc aag tac att ctg ctt ggc cgc agc aag gtc tct gcg    576
Ile Ala Gly Gly Lys Tyr Ile Leu Leu Gly Arg Ser Lys Val Ser Ala
            180                 185                 190

agc gaa ccg gca tgg tgc gct ggc atc act gac gag aag gct gtg caa    624
Ser Glu Pro Ala Trp Cys Ala Gly Ile Thr Asp Glu Lys Ala Val Gln
```

60

```
aag gct gct acc cag gag ctc aag cgc gcc ttt agc gct ggc gag ggc    672
Lys Ala Ala Thr Gln Glu Leu Lys Arg Ala Phe Ser Ala Gly Glu Gly
    210             215             220

ccc aag ccc acg ccc cgc gct gtc act aag ctt gtg ggc tct gtt ctt    720
Pro Lys Pro Thr Pro Arg Ala Val Thr Lys Leu Val Gly Ser Val Leu
225             230             235             240

ggc gct cgc gag gtg cgc agc tct att gct gcg att gaa gcg ctc ggc    768
Gly Ala Arg Glu Val Arg Ser Ser Ile Ala Ala Ile Glu Ala Leu Gly
            245             250             255

ggc aag gcc atc tac tcg tcg tgc gac gtg aac tct gcc gcc gac gtg    816
Gly Lys Ala Ile Tyr Ser Ser Cys Asp Val Asn Ser Ala Ala Asp Val
            260             265             270

gcc aag gcc gtg cgc gat gcc gag tcc cag ctc ggt gcc cgc gtc tcg    864
Ala Lys Ala Val Arg Asp Ala Glu Ser Gln Leu Gly Ala Arg Val Ser
            275             280             285

ggc atc gtt cat gcc tcg ggc gtg ctc cgc gac cgt ctc atc gag aag    912
Gly Ile Val His Ala Ser Gly Val Leu Arg Asp Arg Leu Ile Glu Lys
            290             295             300

aag ctc ccc gac gag ttc gac gcc gtc ttt ggc acc aag gtc acc ggt    960
Lys Leu Pro Asp Glu Phe Asp Ala Val Phe Gly Thr Lys Val Thr Gly
305             310             315             320

ctc gag aac ctc ctc gcc gcc gtc gac cgc gcc aac ctc aag cac atg   1008
Leu Glu Asn Leu Leu Ala Ala Val Asp Arg Ala Asn Leu Lys His Met
            325             330             335

gtc ctc ttc agc tcg ctc gcc ggc ttc cac ggc aac gtc ggc cag tct   1056
Val Leu Phe Ser Ser Leu Ala Gly Phe His Gly Asn Val Gly Gln Ser
            340             345             350

gac tac gcc atg gcc aac gag gcc ctt aac aag atg ggc ctc gag ctc   1104
Asp Tyr Ala Met Ala Asn Glu Ala Leu Asn Lys Met Gly Leu Glu Leu
            355             360             365

gcc aag gac gtc tcg gtc aag tcg atc tgc ttc ggt ccc tgg gac ggt   1152
Ala Lys Asp Val Ser Val Lys Ser Ile Cys Phe Gly Pro Trp Asp Gly
370             375             380

ggc atg gtg acg ccg cag ctc aag aag cag ttc cag gag atg ggc gtg   1200
Gly Met Val Thr Pro Gln Leu Lys Lys Gln Phe Gln Glu Met Gly Val
385             390             395             400

cag atc atc ccc cgc gag ggc ggc gct gat acc gtg gcg cgc atc gtg   1248
Gln Ile Ile Pro Arg Glu Gly Gly Ala Asp Thr Val Ala Arg Ile Val
            405             410             415

ctc ggc tcc tcg ccg gct gag atc ctt gtc ggc aac tgg cgc acc ccg   1296
Leu Gly Ser Ser Pro Ala Glu Ile Leu Val Gly Asn Trp Arg Thr Pro
            420             425             430

tcc aag aag gtc ggc tcg gac acc atc acc ctg cac cgc aag att tcc   1344
Ser Lys Lys Val Gly Ser Asp Thr Ile Thr Leu His Arg Lys Ile Ser
            435             440             445

gcc aag tcc aac ccc ttc ctc gag gac cac gtc atc cag ggc cgc cgc   1392
Ala Lys Ser Asn Pro Phe Leu Glu Asp His Val Ile Gln Gly Arg Arg
            450             455             460

gtg ctg ccc atg acg ctg gcc att ggc tcg ctc gcg gag acc tgc ctc   1440
Val Leu Pro Met Thr Leu Ala Ile Gly Ser Leu Ala Glu Thr Cys Leu
```

61

ggc ctc ttc ccc ggc tac tcg ctc tgg gcc att gac gac gcc cag ctc   1488
Gly Leu Phe Pro Gly Tyr Ser Leu Trp Ala Ile Asp Asp Ala Gln Leu
                    485   490   495

ttc aag ggt gtc act gtc gac ggc gac gtc aac tgc gag gtg acc ctc   1536
Phe Lys Gly Val Thr Val Asp Gly Asp Val Asn Cys Glu Val Thr Leu
                    500   505   510

acc ccg tcg acg gcg ccc tcg ggc cgc gtc aac gtc cag gcc acg ctc   1584
Thr Pro Ser Thr Ala Pro Ser Gly Arg Val Asn Val Gln Ala Thr Leu
                    515   520   525

aag acc ttt tcc agc ggc aag ctg gtc ccg gcc tac cgc gcc gtc atc   1632
Lys Thr Phe Ser Ser Gly Lys Leu Val Pro Ala Tyr Arg Ala Val Ile
                    530   535   540

gtg ctc tcc aac cag ggc gcg ccc ccg gcc aac gcc acc atg cag ccg   1680
Val Leu Ser Asn Gln Gly Ala Pro Pro Ala Asn Ala Thr Met Gln Pro
545   550   555   560

ccc tcg ctc gat gcc gat ccg gcg ctc cag ggc tcc gtc tac gac ggc   1728
Pro Ser Leu Asp Ala Asp Pro Ala Leu Gln Gly Ser Val Tyr Asp Gly
                    565   570   575

aag acc ctc ttc cac ggc ccg gcc ttc cgc ggc atc gat gac gtg ctc   1776
Lys Thr Leu Phe His Gly Pro Ala Phe Arg Gly Ile Asp Asp Val Leu
                    580   585   590

tcg tgc acc aag agc cag ctt gtg gcc aag tgc agc gct gtc ccc ggc   1824
Ser Cys Thr Lys Ser Gln Leu Val Ala Lys Cys Ser Ala Val Pro Gly
                    595   600   605

tcc gac gcc gct cgc ggc gag ttt gcc acg gac act gac gcc cat gac   1872
Ser Asp Ala Ala Arg Gly Glu Phe Ala Thr Asp Thr Asp Ala His Asp
                    610   615   620

ccc ttc gtg aac gac ctg gcc ttt cag gcc atg ctc gtc tgg gtg cgc   1920
Pro Phe Val Asn Asp Leu Ala Phe Gln Ala Met Leu Val Trp Val Arg
625   630   635   640

cgc acg ctc ggc cag gct gcg ctc ccc aac tcg atc cag cgc atc gtc   1968
Arg Thr Leu Gly Gln Ala Ala Leu Pro Asn Ser Ile Gln Arg Ile Val
                    645   650   655

cag cac cgc ccg gtc ccg cag gac aag ccc ttc tac att acc ctc cgc   2016
Gln His Arg Pro Val Pro Gln Asp Lys Pro Phe Tyr Ile Thr Leu Arg
                    660   665   670

tcc aac cag tcg ggc ggt cac tcc cag cac aag cac gcc ctt cag ttc   2064
Ser Asn Gln Ser Gly Gly His Ser Gln His Lys His Ala Leu Gln Phe
                    675   680   685

cac aac gag cag ggc gat ctc ttc att gat gtc cag gct tcg gtc atc   2112
His Asn Glu Gln Gly Asp Leu Phe Ile Asp Val Gln Ala Ser Val Ile
                690   695   700

gcc acg gac agc ctt gcc ttc   2133
Ala Thr Asp Ser Leu Ala Phe
705   710

<210>   18
<211>   711
<212>   PRT
<213>   Schizochytrium sp.

<400> 18

Phe Gly Ala Leu Gly Gly Phe Ile Ser Gln Gln Ala Glu Arg Phe Glu
1   5   10   15

Pro Ala Glu Ile Leu Gly Phe Thr Leu Met Cys Ala Lys Phe Ala Lys
            20   25   30

Ala Ser Leu Cys Thr Ala Val Ala Gly Gly Arg Pro Ala Phe Ile Gly
            35   40   45

Val Ala Arg Leu Asp Gly Arg Leu Gly Phe Thr Ser Gln Gly Thr Ser
        50   55   60

Asp Ala Leu Lys Arg Ala Gln Arg Gly Ala Ile Phe Gly Leu Cys Lys
65   70   75   80

Thr Ile Gly Leu Glu Trp Ser Glu Ser Asp Val Phe Ser Arg Gly Val
                85   90   95

Asp Ile Ala Gln Gly Met His Pro Glu Asp Ala Ala Val Ala Ile Val
            100   105   110

Arg Glu Met Ala Cys Ala Asp Ile Arg Ile Arg Glu Val Gly Ile Gly
        115   120   125

Ala Asn Gln Gln Arg Cys Thr Ile Arg Ala Ala Lys Leu Glu Thr Gly
        130   135   140

Asn Pro Gln Arg Gln Ile Ala Lys Asp Asp Val Leu Leu Val Ser Gly
145   150   155   160

Gly Ala Arg Gly Ile Thr Pro Leu Cys Ile Arg Glu Ile Thr Arg Gln
                165   170   175

Ile Ala Gly Gly Lys Tyr Ile Leu Leu Gly Arg Ser Lys Val Ser Ala
            180   185   190

Ser Glu Pro Ala Trp Cys Ala Gly Ile Thr Asp Glu Lys Ala Val Gln
        195   200   205

Lys Ala Ala Thr Gln Glu Leu Lys Arg Ala Phe Ser Ala Gly Glu Gly
    210   215   220

Pro Lys Pro Thr Pro Arg Ala Val Thr Lys Leu Val Gly Ser Val Leu
225   230   235   240

Gly Ala Arg Glu Val Arg Ser Ser Ile Ala Ala Ile Glu Ala Leu Gly
            245   250   255

Gly Lys Ala Ile Tyr Ser Ser Cys Asp Val Asn Ser Ala Ala Asp Val
            260   265   270

63

Ala Lys Ala Val Arg Asp Ala Glu Ser Gln Leu Gly Ala Arg Val Ser
        275   280   285

Gly Ile Val His Ala Ser Gly Val Leu Arg Asp Arg Leu Ile Glu Lys
        290   295   300

Lys Leu Pro Asp Glu Phe Asp Ala Val Phe Gly Thr Lys Val Thr Gly
305   310   315   320

Leu Glu Asn Leu Leu Ala Ala Val Asp Arg Ala Asn Leu Lys His Met
                325   330   335

Val Leu Phe Ser Ser Leu Ala Gly Phe His Gly Asn Val Gly Gln Ser
                340   345   350

Asp Tyr Ala Met Ala Asn Glu Ala Leu Asn Lys Met Gly Leu Glu Leu
        355   360   365

Ala Lys Asp Val Ser Val Lys Ser Ile Cys Phe Gly Pro Trp Asp Gly
        370   375   380

Gly Met Val Thr Pro Gln Leu Lys Lys Gln Phe Gln Glu Met Gly Val
385   390   395   400

Gln Ile Ile Pro Arg Glu Gly Gly Ala Asp Thr Val Ala Arg Ile Val
                405   410   415

Leu Gly Ser Ser Pro Ala Glu Ile Leu Val Gly Asn Trp Arg Thr Pro
                420   425   430

Ser Lys Lys Val Gly Ser Asp Thr Ile Thr Leu His Arg Lys Ile Ser
        435   440   445

Ala Lys Ser Asn Pro Phe Leu Glu Asp His Val Ile Gln Gly Arg Arg
        450   455   460

Val Leu Pro Met Thr Leu Ala Ile Gly Ser Leu Ala Glu Thr Cys Leu
465   470   475   480

Gly Leu Phe Pro Gly Tyr Ser Leu Trp Ala Ile Asp Asp Ala Gln Leu
                485   490   495

Phe Lys Gly Val Thr Val Asp Gly Asp Val Asn Cys Glu Val Thr Leu
            500   505   510

Thr Pro Ser Thr Ala Pro Ser Gly Arg Val Asn Val Gln Ala Thr Leu
        515   520   525

Lys Thr Phe Ser Ser Gly Lys Leu Val Pro Ala Tyr Arg Ala Val Ile
        530   535   540

64

```
Val Leu Ser Asn Gln Gly Ala Pro Pro Ala Asn Ala Thr Met Gln Pro
545             550             555             560


Pro Ser Leu Asp Ala Asp Pro Ala Leu Gln Gly Ser Val Tyr Asp Gly
            565             570             575


Lys Thr Leu Phe His Gly Pro Ala Phe Arg Gly Ile Asp Asp Val Leu
            580             585             590


Ser Cys Thr Lys Ser Gln Leu Val Ala Lys Cys Ser Ala Val Pro Gly
            595             600             605


Ser Asp Ala Ala Arg Gly Glu Phe Ala Thr Asp Thr Asp Ala His Asp
    610             615             620


Pro Phe Val Asn Asp Leu Ala Phe Gln Ala Met Leu Val Trp Val Arg
625             630             635             640


Arg Thr Leu Gly Gln Ala Ala Leu Pro Asn Ser Ile Gln Arg Ile Val
            645             650             655


Gln His Arg Pro Val Pro Gln Asp Lys Pro Phe Tyr Ile Thr Leu Arg
            660             665             670


Ser Asn Gln Ser Gly Gly His Ser Gln His Lys His Ala Leu Gln Phe
        675             680             685


His Asn Glu Gln Gly Asp Leu Phe Ile Asp Val Gln Ala Ser Val Ile
    690             695             700


Ala Thr Asp Ser Leu Ala Phe
705             710


<210>   19
<211>   1350
<212>   DNA
<213>   Schizochytrium sp.


<220>
<221>   CDS
<222>   (1)..(1350)

<400>   19
atg gcc gct cgg aat gtg agc gcc gcg cat gag atg cac gat gaa aag      48
Met Ala Ala Arg Asn Val Ser Ala Ala His Glu Met His Asp Glu Lys
1               5                   10                  15

cgc atc gcc gtc gtc ggc atg gcc gtc cag tac gcc gga tgc aaa acc      96
Arg Ile Ala Val Val Gly Met Ala Val Gln Tyr Ala Gly Cys Lys Thr
            20                  25                  30

aag gac gag ttc tgg gag gtg ctc atg aac ggc aag gtc gag tcc aag     144
Lys Asp Glu Phe Trp Glu Val Leu Met Asn Gly Lys Val Glu Ser Lys
        35                  40                  45

gtg atc agc gac aaa cga ctc ggc tcc aac tac cgc gcc gag cac tac     192
```

65

```
Val Ile Ser Asp Lys Arg Leu Gly Ser Asn Tyr Arg Ala Glu His Tyr
    50              55              60

aaa gca gag cgc agc aag tat gcc gac acc ttt tgc aac gaa acg tac        240
Lys Ala Glu Arg Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Thr Tyr
65              70              75              80

ggc acc ctt gac gag aac gag atc gac aac gag cac gaa ctc ctc ctc        288
Gly Thr Leu Asp Glu Asn Glu Ile Asp Asn Glu His Glu Leu Leu Leu
                85              90              95

aac ctc gcc aag cag gca ctc gca gag aca tcc gtc aaa gac tcg aca        336
Asn Leu Ala Lys Gln Ala Leu Ala Glu Thr Ser Val Lys Asp Ser Thr
                100             105             110

cgc tgc ggc atc gtc agc ggc tgc ctc tcg ttc ccc atg gac aac ctc        384
Arg Cys Gly Ile Val Ser Gly Cys Leu Ser Phe Pro Met Asp Asn Leu
            115             120             125

cag ggt gaa ctc ctc aac gtg tac caa aac cat gtc gag aaa aag ctc        432
Gln Gly Glu Leu Leu Asn Val Tyr Gln Asn His Val Glu Lys Lys Leu
    130             135             140

ggg gcc cgc gtc ttc aag gac gcc tcc cat tgg tcc gaa cgc gag cag        480
Gly Ala Arg Val Phe Lys Asp Ala Ser His Trp Ser Glu Arg Glu Gln
145             150             155             160

tcc aac aaa ccc gag gcc ggt gac cgc cgc atc ttc atg gac ccg gcc        528
Ser Asn Lys Pro Glu Ala Gly Asp Arg Arg Ile Phe Met Asp Pro Ala
                165             170             175

tcc ttc gtc gcc gaa gaa ctc aac ctc ggc gcc ctt cac tac tcc gtc        576
Ser Phe Val Ala Glu Glu Leu Asn Leu Gly Ala Leu His Tyr Ser Val
                180             185             190

gac gca gca tgc gcc acg gcg ctc tac gtg ctc cgc ctc gcg cag gat        624
Asp Ala Ala Cys Ala Thr Ala Leu Tyr Val Leu Arg Leu Ala Gln Asp
            195             200             205

cat ctc gtc tcc ggc gcc gcc gac gtc atg ctc tgc ggt gcc acc tgc        672
His Leu Val Ser Gly Ala Ala Asp Val Met Leu Cys Gly Ala Thr Cys
    210             215             220

ctg ccg gag ccc ttt ttc atc ctt tcg ggc ttt tcc acc ttc cag gcc        720
Leu Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe Ser Thr Phe Gln Ala
225             230             235             240

atg ccc gtc ggc acg ggc cag aac gtg tcc atg ccg ctg cac aag gac        768
Met Pro Val Gly Thr Gly Gln Asn Val Ser Met Pro Leu His Lys Asp
                245             250             255

agc cag ggc ctc acc ccg ggt gag ggc ggc tcc atc atg gtc ctc aag        816
Ser Gln Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile Met Val Leu Lys
                260             265             270

cgt ctc gat gat gcc atc cgc gac ggc gac cac att tac ggc acc ctt        864
Arg Leu Asp Asp Ala Ile Arg Asp Gly Asp His Ile Tyr Gly Thr Leu
                275             280             285

ctc ggc gcc aat gtc agc aac tcc ggc aca ggt ctg ccc ctc aag ccc        912
Leu Gly Ala Asn Val Ser Asn Ser Gly Thr Gly Leu Pro Leu Lys Pro
    290             295             300

ctt ctc ccc agc gag aaa aag tgc ctc atg gac acc tac acg cgc att        960
Leu Leu Pro Ser Glu Lys Lys Cys Leu Met Asp Thr Tyr Thr Arg Ile
305             310             315             320

aac gtg cac ccg cac aag att cag tac gtc gag tgc cac gcc acc ggc        1008
```
66

```
Asn Val His Pro His Lys Ile Gln Tyr Val Glu Cys His Ala Thr Gly
            325                 330                 335

acg ccc cag ggt gat cgt gtg gaa atc gac gcc gtc aag gcc tgc ttt    1056
Thr Pro Gln Gly Asp Arg Val Glu Ile Asp Ala Val Lys Ala Cys Phe
            340                 345                 350

gaa ggc aag gtc ccc cgt ttc ggt acc aca aag ggc aac ttt gga cac    1104
Glu Gly Lys Val Pro Arg Phe Gly Thr Thr Lys Gly Asn Phe Gly His
            355                 360                 365

acc cts gyc gca gcc ggc ttt gcc ggt atg tgc aag gtc ctc ctc tcc    1152
Thr Xaa Ala Ala Gly Phe Ala Gly Met Cys Lys Val Leu Leu Ser
    370                 375                 380

atg aag cat ggc atc atc ccg ccc acc ccg ggt atc gat gac gag acc    1200
Met Lys His Gly Ile Ile Pro Pro Thr Pro Gly Ile Asp Asp Glu Thr
385                 390                 395                 400

aag atg gac cct ctc gtc gtc tcc ggt gag gcc atc cca tgg cca gag    1248
Lys Met Asp Pro Leu Val Val Ser Gly Glu Ala Ile Pro Trp Pro Glu
            405                 410                 415

acc aac ggc gag ccc aag cgc gcc ggt ctc tcg gcc ttt ggc ttt ggt    1296
Thr Asn Gly Glu Pro Lys Arg Ala Gly Leu Ser Ala Phe Gly Phe Gly
            420                 425                 430

ggc acc aac gcc cat gcc gtc ttt gag gag cat gac ccc tcc aac gcc    1344
Gly Thr Asn Ala His Ala Val Phe Glu Glu His Asp Pro Ser Asn Ala
            435                 440                 445

gcc tgc                                                            1350
Ala Cys
    450


<210>  20
<211>  450
<212>  PRT
<213>  Schizochytrium sp.

<220>
<221>  misc_feature
<222>  (370)..(370)
<223>  The 'Xaa' at location 370 stands for Leu.

<220>
<221>  misc_feature
<222>  (371)..(371)
<223>  The 'Xaa' at location 371 stands for Ala, or Val.

<400>  20

Met Ala Ala Arg Asn Val Ser Ala Ala His Glu Met His Asp Glu Lys
1                5                   10                  15


Arg Ile Ala Val Val Gly Met Ala Val Gln Tyr Ala Gly Cys Lys Thr
                20                  25                  30


Lys Asp Glu Phe Trp Glu Val Leu Met Asn Gly Lys Val Glu Ser Lys
            35                  40                  45


Val Ile Ser Asp Lys Arg Leu Gly Ser Asn Tyr Arg Ala Glu His Tyr
    50                  55                  60
```

67

```
Lys Ala Glu Arg Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Thr Tyr
65              70              75              80

Gly Thr Leu Asp Glu Asn Glu Ile Asp Asn Glu His Glu Leu Leu Leu
            85              90              95

Asn Leu Ala Lys Gln Ala Leu Ala Glu Thr Ser Val Lys Asp Ser Thr
            100             105             110

Arg Cys Gly Ile Val Ser Gly Cys Leu Ser Phe Pro Met Asp Asn Leu
        115             120             125

Gln Gly Glu Leu Leu Asn Val Tyr Gln Asn His Val Glu Lys Lys Leu
    130             135             140

Gly Ala Arg Val Phe Lys Asp Ala Ser His Trp Ser Glu Arg Glu Gln
145             150             155             160

Ser Asn Lys Pro Glu Ala Gly Asp Arg Arg Ile Phe Met Asp Pro Ala
            165             170             175

Ser Phe Val Ala Glu Glu Leu Asn Leu Gly Ala Leu His Tyr Ser Val
        180             185             190

Asp Ala Ala Cys Ala Thr Ala Leu Tyr Val Leu Arg Leu Ala Gln Asp
        195             200             205

His Leu Val Ser Gly Ala Ala Asp Val Met Leu Cys Gly Ala Thr Cys
    210             215             220

Leu Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe Ser Thr Phe Gln Ala
225             230             235             240

Met Pro Val Gly Thr Gly Gln Asn Val Ser Met Pro Leu His Lys Asp
            245             250             255

Ser Gln Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile Met Val Leu Lys
        260             265             270

Arg Leu Asp Asp Ala Ile Arg Asp Gly Asp His Ile Tyr Gly Thr Leu
        275             280             285

Leu Gly Ala Asn Val Ser Asn Ser Gly Thr Gly Leu Pro Leu Lys Pro
    290             295             300

Leu Leu Pro Ser Glu Lys Lys Cys Leu Met Asp Thr Tyr Thr Arg Ile
305             310             315             320

Asn Val His Pro His Lys Ile Gln Tyr Val Glu Cys His Ala Thr Gly
            325             330             335
```

68

```
Thr Pro Gln Gly Asp Arg Val Glu Ile Asp Ala Val Lys Ala Cys Phe
            340                 345                 350

Glu Gly Lys Val Pro Arg Phe Gly Thr Thr Lys Gly Asn Phe Gly His
            355                 360                 365

Thr Xaa Xaa Ala Ala Gly Phe Ala Gly Met Cys Lys Val Leu Leu Ser
    370                 375                 380

Met Lys His Gly Ile Ile Pro Pro Thr Pro Gly Ile Asp Asp Glu Thr
385                 390                 395                 400

Lys Met Asp Pro Leu Val Val Ser Gly Glu Ala Ile Pro Trp Pro Glu
            405                 410                 415

Thr Asn Gly Glu Pro Lys Arg Ala Gly Leu Ser Ala Phe Gly Phe Gly
            420                 425                 430

Gly Thr Asn Ala His Ala Val Phe Glu Glu His Asp Pro Ser Asn Ala
            435                 440                 445

Ala Cys
    450


<210>   21
<211>   1323
<212>   DNA
<213>   Schizochytrium sp.


<220>
<221>   CDS
<222>   (1)..(1323)

<400>   21
tcg gcc cgc tgc ggc ggt gaa agc aac atg cgc atc gcc atc act ggt        48
Ser Ala Arg Cys Gly Gly Glu Ser Asn Met Arg Ile Ala Ile Thr Gly
1               5                   10                  15

atg gac gcc acc ttt ggc gct ctc aag gga ctc gac gcc ttc gag cgc        96
Met Asp Ala Thr Phe Gly Ala Leu Lys Gly Leu Asp Ala Phe Glu Arg
                20                  25                  30

gcc att tac acc ggc gct cac ggt gcc atc cca ctc cca gaa aag cgc        144
Ala Ile Tyr Thr Gly Ala His Gly Ala Ile Pro Leu Pro Glu Lys Arg
            35                  40                  45

tgg cgc ttt ctc ggc aag gac aag gac ttt ctt gac ctc tgc ggc gtc        192
Trp Arg Phe Leu Gly Lys Asp Lys Asp Phe Leu Asp Leu Cys Gly Val
    50                  55                  60

aag gcc acc ccg cac ggc tgc tac att gaa gat gtt gag gtc gac ttc        240
Lys Ala Thr Pro His Gly Cys Tyr Ile Glu Asp Val Glu Val Asp Phe
65                  70                  75                  80

cag cgc ctc cgc acg ccc atg acc cct gaa gac atg ctc ctc cct cag        288
Gln Arg Leu Arg Thr Pro Met Thr Pro Glu Asp Met Leu Leu Pro Gln
                85                  90                  95

cag ctt ctg gcc gtc acc acc att gac cgc gcc atc ctc gac tcg gga        336
```

69

```
Gln Leu Leu Ala Val Thr Thr Ile Asp Arg Ala Ile Leu Asp Ser Gly
        100                 105                 110

atg aaa aag ggt ggc aat gtc gcc gtc ttt gtc ggc ctc ggc acc gac      384
Met Lys Lys Gly Gly Asn Val Ala Val Phe Val Gly Leu Gly Thr Asp
        115                 120                 125

ctc gag ctc tac cgt cac cgt gct cgc gtc gct ctc aag gag cgc gtc      432
Leu Glu Leu Tyr Arg His Arg Ala Arg Val Ala Leu Lys Glu Arg Val
        130                 135                 140

cgc cct gaa gcc tcc aag aag ctc aat gac atg atg cag tac att aac      480
Arg Pro Glu Ala Ser Lys Lys Leu Asn Asp Met Met Gln Tyr Ile Asn
145                 150                 155                 160

gac tgc ggc aca tcc aca tcg tac acc tcg tac att ggc aac ctc gtc      528
Asp Cys Gly Thr Ser Thr Ser Tyr Thr Ser Tyr Ile Gly Asn Leu Val
                165                 170                 175

gcc acg cgc gtc tcg tcg cag tgg ggc ttc acg ggc ccc tcc ttt acg      576
Ala Thr Arg Val Ser Ser Gln Trp Gly Phe Thr Gly Pro Ser Phe Thr
                180                 185                 190

atc acc gag ggc aac aac tcc gtc tac cgc tgc gcc gag ctc ggc aag      624
Ile Thr Glu Gly Asn Asn Ser Val Tyr Arg Cys Ala Glu Leu Gly Lys
        195                 200                 205

tac ctc ctc gag acc ggc gag gtc gat ggc gtc gtc gtt gcg ggt gtc      672
Tyr Leu Leu Glu Thr Gly Glu Val Asp Gly Val Val Val Ala Gly Val
        210                 215                 220

gat ctc tgc ggc agt gcc gaa aac ctt tac gtc aag tct cgc cgc ttc      720
Asp Leu Cys Gly Ser Ala Glu Asn Leu Tyr Val Lys Ser Arg Arg Phe
225                 230                 235                 240

aag gtg tcc acc tcc gat acc ccg cgc gcc agc ttt gac gcc gcc gcc      768
Lys Val Ser Thr Ser Asp Thr Pro Arg Ala Ser Phe Asp Ala Ala Ala
                245                 250                 255

gat ggc tac ttt gtc ggc gag ggc tgc ggt gcc ttt gtg ctc aag cgt      816
Asp Gly Tyr Phe Val Gly Glu Gly Cys Gly Ala Phe Val Leu Lys Arg
                260                 265                 270

gag act agc tgc acc aag gac gac cgt atc tac gct tgc atg gat gcc      864
Glu Thr Ser Cys Thr Lys Asp Asp Arg Ile Tyr Ala Cys Met Asp Ala
        275                 280                 285

atc gtc cct ggc aac gtc cct agc gcc tgc ttg cgc gag gcc ctc gac      912
Ile Val Pro Gly Asn Val Pro Ser Ala Cys Leu Arg Glu Ala Leu Asp
        290                 295                 300

cag gcg cgc gtc aag ccg ggc gat atc gag atg ctc gag ctc agc gcc      960
Gln Ala Arg Val Lys Pro Gly Asp Ile Glu Met Leu Glu Leu Ser Ala
305                 310                 315                 320

gac tcc gcc cgc cac ctc aag gac ccg tcc gtc ctg ccc aag gag ctc     1008
Asp Ser Ala Arg His Leu Lys Asp Pro Ser Val Leu Pro Lys Glu Leu
                325                 330                 335

act gcc gag gag gaa atc ggc ggc ctt cag acg atc ctt cgt gac gat     1056
Thr Ala Glu Glu Glu Ile Gly Gly Leu Gln Thr Ile Leu Arg Asp Asp
                340                 345                 350

gac aag ctc ccg cgc aac gtc gca acg ggc agt gtc aag gcc acc gtc     1104
Asp Lys Leu Pro Arg Asn Val Ala Thr Gly Ser Val Lys Ala Thr Val
        355                 360                 365        /
                                                         /
ggt gac acc ggt tat gcc tct ggt gct gcc agc ctc atc aag gct gcg     1152
```

```
Gly Asp Thr Gly Tyr Ala Ser Gly Ala Ala Ser Leu Ile Lys Ala Ala
    370             375             380

ctt tgc atc tac aac cgc tac ctg ccc agc aac ggc gac gac tgg gat        1200
Leu Cys Ile Tyr Asn Arg Tyr Leu Pro Ser Asn Gly Asp Asp Trp Asp
385             390             395             400

gaa ccc gcc cct gag gcg ccc tgg gac agc acc ctc ttt gcg tgc cag        1248
Glu Pro Ala Pro Glu Ala Pro Trp Asp Ser Thr Leu Phe Ala Cys Gln
            405             410             415

acc tcg cgc gct tgg ctc aag aac cct ggc gag cgt cgc tat gcg gcc        1296
Thr Ser Arg Ala Trp Leu Lys Asn Pro Gly Glu Arg Arg Tyr Ala Ala
            420             425             430

gtc tcg ggc gtc tcc gag acg cgc tcg                                    1323
Val Ser Gly Val Ser Glu Thr Arg Ser
            435             440
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<210> 22
<211> 441
<212> PRT
<213> Schizochytrium sp.

<400> 22

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Ser Ala Arg Cys Gly Gly Glu Ser Asn Met Arg Ile Ala Ile Thr Gly
1               5               10              15


Met Asp Ala Thr Phe Gly Ala Leu Lys Gly Leu Asp Ala Phe Glu Arg
            20              25              30


Ala Ile Tyr Thr Gly Ala His Gly Ala Ile Pro Leu Pro Glu Lys Arg
        35              40              45


Trp Arg Phe Leu Gly Lys Asp Lys Asp Phe Leu Asp Leu Cys Gly Val
    50              55              60


Lys Ala Thr Pro His Gly Cys Tyr Ile Glu Asp Val Glu Val Asp Phe
65              70              75              80


Gln Arg Leu Arg Thr Pro Met Thr Pro Glu Asp Met Leu Leu Pro Gln
            85              90              95


Gln Leu Leu Ala Val Thr Thr Ile Asp Arg Ala Ile Leu Asp Ser Gly
            100             105             110


Met Lys Lys Gly Gly Asn Val Ala Val Phe Val Gly Leu Gly Thr Asp
            115             120             125


Leu Glu Leu Tyr Arg His Arg Ala Arg Val Ala Leu Lys Glu Arg Val
    130             135             140


Arg Pro Glu Ala Ser Lys Lys Leu Asn Asp Met Met Gln Tyr Ile Asn
145             150             155             160


Asp Cys Gly Thr Ser Thr Ser Tyr Thr Ser Tyr Ile Gly Asn Leu Val
```

71

Ala Thr Arg Val Ser Ser Gln Trp Gly Phe Thr Gly Pro Ser Phe Thr
    180   185   190

Ile Thr Glu Gly Asn Asn Ser Val Tyr Arg Cys Ala Glu Leu Gly Lys
    195   200   205

Tyr Leu Leu Glu Thr Gly Glu Val Asp Gly Val Val Val Ala Gly Val
    210   215   220

Asp Leu Cys Gly Ser Ala Glu Asn Leu Tyr Val Lys Ser Arg Arg Phe
225   230   235   240

Lys Val Ser Thr Ser Asp Thr Pro Arg Ala Ser Phe Asp Ala Ala Ala
    245   250   255

Asp Gly Tyr Phe Val Gly Glu Gly Cys Gly Ala Phe Val Leu Lys Arg
    260   265   270

Glu Thr Ser Cys Thr Lys Asp Asp Arg Ile Tyr Ala Cys Met Asp Ala
    275   280   285

Ile Val Pro Gly Asn Val Pro Ser Ala Cys Leu Arg Glu Ala Leu Asp
    290   295   300

Gln Ala Arg Val Lys Pro Gly Asp Ile Glu Met Leu Glu Leu Ser Ala
305   310   315   320

Asp Ser Ala Arg His Leu Lys Asp Pro Ser Val Leu Pro Lys Glu Leu
    325   330   335

Thr Ala Glu Glu Glu Ile Gly Gly Leu Gln Thr Ile Leu Arg Asp Asp
    340   345   350

Asp Lys Leu Pro Arg Asn Val Ala Thr Gly Ser Val Lys Ala Thr Val
    355   360   365

Gly Asp Thr Gly Tyr Ala Ser Gly Ala Ala Ser Leu Ile Lys Ala Ala
    370   375   380

Leu Cys Ile Tyr Asn Arg Tyr Leu Pro Ser Asn Gly Asp Asp Trp Asp
385   390   395   400

Glu Pro Ala Pro Glu Ala Pro Trp Asp Ser Thr Leu Phe Ala Cys Gln
    405   410   415

Thr Ser Arg Ala Trp Leu Lys Asn Pro Gly Glu Arg Arg Tyr Ala Ala
    420   425   430

Val Ser Gly Val Ser Glu Thr Arg Ser

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<210>   23
<211>   1500
<212>   DNA
<213>   Schizochytrium sp.


<220>
<221>   CDS
<222>   (1)..(1500)

<400>   23
tgc tat tcc gtg ctc ctc tcc gaa gcc gag ggc cac tac gag cgc gag        48
Cys Tyr Ser Val Leu Leu Ser Glu Ala Glu Gly His Tyr Glu Arg Glu
1               5               10                  15

aac cgc atc tcg ctc gac gag gag gcg ccc aag ctc att gtg ctt cgc        96
Asn Arg Ile Ser Leu Asp Glu Glu Ala Pro Lys Leu Ile Val Leu Arg
                20                  25                  30

gcc gac tcc cac gag gag atc ctt ggt cgc ctc gac aag atc cgc gag       144
Ala Asp Ser His Glu Glu Ile Leu Gly Arg Leu Asp Lys Ile Arg Glu
            35                  40                  45

cgc ttc ttg cag ccc acg ggc gcc gcc ccg cgc gag tcc gag ctc aag       192
Arg Phe Leu Gln Pro Thr Gly Ala Ala Pro Arg Glu Ser Glu Leu Lys
        50                  55                  60

gcg cag gcc cgc cgc atc ttc ctc gag ctc ctc ggc gag acc ctt gcc       240
Ala Gln Ala Arg Arg Ile Phe Leu Glu Leu Leu Gly Glu Thr Leu Ala
65                  70                  75                  80

cag gat gcc gct tct tca ggc tcg caa aag ccc ctc gct ctc agc ctc       288
Gln Asp Ala Ala Ser Ser Gly Ser Gln Lys Pro Leu Ala Leu Ser Leu
                85                  90                  95

gtc tcc acg ccc tcc aag ctc cag cgc gag gtc gag ctc gcg gcc aag       336
Val Ser Thr Pro Ser Lys Leu Gln Arg Glu Val Glu Leu Ala Ala Lys
                100                 105                 110

ggt atc ccg cgc tgc ctc aag atg cgc cgc gat tgg agc tcc cct gct       384
Gly Ile Pro Arg Cys Leu Lys Met Arg Arg Asp Trp Ser Ser Pro Ala
            115                 120                 125

ggc agc cgc tac gcg cct gag ccg ctc gcc agc gac cgc gtc gcc ttc       432
Gly Ser Arg Tyr Ala Pro Glu Pro Leu Ala Ser Asp Arg Val Ala Phe
        130                 135                 140

atg tac ggc gaa ggt cgc agc cct tac tac ggc atc acc caa gac att       480
Met Tyr Gly Glu Gly Arg Ser Pro Tyr Tyr Gly Ile Thr Gln Asp Ile
145                 150                 155                 160

cac cgc att tgg ccc gaa ctc cac gag gtc atc aac gaa aag acg aac       528
His Arg Ile Trp Pro Glu Leu His Glu Val Ile Asn Glu Lys Thr Asn
                165                 170                 175

cgt ctc tgg gcc gaa ggc gac cgc tgg gtc atg ccg cgc gcc agc ttc       576
Arg Leu Trp Ala Glu Gly Asp Arg Trp Val Met Pro Arg Ala Ser Phe
                180                 185                 190

aag tcg gag ctc gag agc cag cag caa gag ttt gat cgc aac atg att       624
Lys Ser Glu Leu Glu Ser Gln Gln Gln Glu Phe Asp Arg Asn Met Ile
            195                 200                 205

gaa atg ttc cgt ctt gga atc ctc acc tca att gcc ttc acc aat ctg       672
Glu Met Phe Arg Leu Gly Ile Leu Thr Ser Ile Ala Phe Thr Asn Leu
```

73

```
gcg cgc gac gtt ctc aac atc acg ccc aag gcc gcc ttt ggc ctc agt       720
Ala Arg Asp Val Leu Asn Ile Thr Pro Lys Ala Ala Phe Gly Leu Ser
225             230             235                     240

ctt ggc gag att tcc atg att ttt gcc ttt tcc aag aag aac ggt ctc       768
Leu Gly Glu Ile Ser Met Ile Phe Ala Phe Ser Lys Lys Asn Gly Leu
                245             250             255

atc tcc gac cag ctc acc aag gat ctt cgc gag tcc gac gtg tgg aac       816
Ile Ser Asp Gln Leu Thr Lys Asp Leu Arg Glu Ser Asp Val Trp Asn
            260             265             270

aag gct ctg gcc gtt gaa ttt aat gcg ctg cgc gag gcc tgg ggc att       864
Lys Ala Leu Ala Val Glu Phe Asn Ala Leu Arg Glu Ala Trp Gly Ile
        275             280             285

cca cag agt gtc ccc aag gac gag ttc tgg caa ggc tac att gtg cgc       912
Pro Gln Ser Val Pro Lys Asp Glu Phe Trp Gln Gly Tyr Ile Val Arg
    290             295             300

ggc acc aag cag gat atc gag gcg gcc atc gcc ccg gac agc aag tac       960
Gly Thr Lys Gln Asp Ile Glu Ala Ala Ile Ala Pro Asp Ser Lys Tyr
305             310             315             320

gtg cgc ctc acc atc atc aat gat gcc aac acc gcc ctc att agc ggc      1008
Val Arg Leu Thr Ile Ile Asn Asp Ala Asn Thr Ala Leu Ile Ser Gly
            325             330             335

aag ccc gac gcc tgc aag gct gcg atc gcg cgt ctc ggt ggc aac att      1056
Lys Pro Asp Ala Cys Lys Ala Ala Ile Ala Arg Leu Gly Gly Asn Ile
            340             345             350

cct gcg ctt ccc gtg acc cag ggc atg tgc ggc cac tgc ccc gag gtg      1104
Pro Ala Leu Pro Val Thr Gln Gly Met Cys Gly His Cys Pro Glu Val
        355             360             365

gga cct tat acc aag gat atc gcc aag atc cat gcc aac ctt gag ttc      1152
Gly Pro Tyr Thr Lys Asp Ile Ala Lys Ile His Ala Asn Leu Glu Phe
    370             375             380

ccc gtt gtc gac ggc ctt gac ctc tgg acc aca atc aac cag aag cgc      1200
Pro Val Val Asp Gly Leu Asp Leu Trp Thr Thr Ile Asn Gln Lys Arg
385             390             395             400

ctc gtg cca cgc gcc acg ggc gcc aag gac gaa tgg gcc cct tct tcc      1248
Leu Val Pro Arg Ala Thr Gly Ala Lys Asp Glu Trp Ala Pro Ser Ser
            405             410             415

ttt ggc gag tac gcc ggc cag ctc tac gag aag cag gct aac ttc ccc      1296
Phe Gly Glu Tyr Ala Gly Gln Leu Tyr Glu Lys Gln Ala Asn Phe Pro
            420             425             430

caa atc gtc gag acc att tac aag caa aac tac gac gtc ttt gtc gag      1344
Gln Ile Val Glu Thr Ile Tyr Lys Gln Asn Tyr Asp Val Phe Val Glu
        435             440             445

gtt ggg ccc aac aac cac cgt agc acc gca gtg cgc acc acg ctt ggt      1392
Val Gly Pro Asn Asn His Arg Ser Thr Ala Val Arg Thr Thr Leu Gly
    450             455             460

ccc cag cgc aac cac ctt gct ggc gcc atc gac aag cag aac gag gat      1440
Pro Gln Arg Asn His Leu Ala Gly Ala Ile Asp Lys Gln Asn Glu Asp
465             470             475             480

gct tgg acg acc atc gtc aag ctt gtg gct tcg ctc aag gcc cac ctt      1488
Ala Trp Thr Thr Ile Val Lys Leu Val Ala Ser Leu Lys Ala His Leu
```

```
gtt cct ggc gtc                                          1500
Val Pro Gly Val
            500
```

```
<210>   24
<211>   500
<212>   PRT
<213>   Schizochytrium sp.

<400>   24
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Cys Tyr Ser Val Leu Leu Ser Glu Ala Glu Gly His Tyr Glu Arg Glu
1               5                   10                  15


Asn Arg Ile Ser Leu Asp Glu Glu Ala Pro Lys Leu Ile Val Leu Arg
            20                  25                  30


Ala Asp Ser His Glu Glu Ile Leu Gly Arg Leu Asp Lys Ile Arg Glu
            35                  40                  45


Arg Phe Leu Gln Pro Thr Gly Ala Ala Pro Arg Glu Ser Glu Leu Lys
    50                  55                  60


Ala Gln Ala Arg Arg Ile Phe Leu Glu Leu Leu Gly Glu Thr Leu Ala
65                  70                  75                  80


Gln Asp Ala Ala Ser Ser Gly Ser Gln Lys Pro Leu Ala Leu Ser Leu
                85                  90                  95


Val Ser Thr Pro Ser Lys Leu Gln Arg Glu Val Glu Leu Ala Ala Lys
            100                 105                 110


Gly Ile Pro Arg Cys Leu Lys Met Arg Arg Asp Trp Ser Ser Pro Ala
            115                 120                 125


Gly Ser Arg Tyr Ala Pro Glu Pro Leu Ala Ser Asp Arg Val Ala Phe
    130                 135                 140


Met Tyr Gly Glu Gly Arg Ser Pro Tyr Tyr Gly Ile Thr Gln Asp Ile
145                 150                 155                 160


His Arg Ile Trp Pro Glu Leu His Glu Val Ile Asn Glu Lys Thr Asn
                165                 170                 175


Arg Leu Trp Ala Glu Gly Asp Arg Trp Val Met Pro Arg Ala Ser Phe
            180                 185                 190


Lys Ser Glu Leu Glu Ser Gln Gln Gln Glu Phe Asp Arg Asn Met Ile
            195                 200                 205


Glu Met Phe Arg Leu Gly Ile Leu Thr Ser Ile Ala Phe Thr Asn Leu
    210                 215                 220
```

75

Ala Arg Asp Val Leu Asn Ile Thr Pro Lys Ala Ala Phe Gly Leu Ser
225   230   235   240

Leu Gly Glu Ile Ser Met Ile Phe Ala Phe Ser Lys Lys Asn Gly Leu
                245   250   255

Ile Ser Asp Gln Leu Thr Lys Asp Leu Arg Glu Ser Asp Val Trp Asn
                260   265   270

Lys Ala Leu Ala Val Glu Phe Asn Ala Leu Arg Glu Ala Trp Gly Ile
                275   280   285

Pro Gln Ser Val Pro Lys Asp Glu Phe Trp Gln Gly Tyr Ile Val Arg
    290   295   300

Gly Thr Lys Gln Asp Ile Glu Ala Ala Ile Ala Pro Asp Ser Lys Tyr
305   310   315   320

Val Arg Leu Thr Ile Ile Asn Asp Ala Asn Thr Ala Leu Ile Ser Gly
                325   330   335

Lys Pro Asp Ala Cys Lys Ala Ala Ile Ala Arg Leu Gly Gly Asn Ile
                340   345   350

Pro Ala Leu Pro Val Thr Gln Gly Met Cys Gly His Cys Pro Glu Val
                355   360   365

Gly Pro Tyr Thr Lys Asp Ile Ala Lys Ile His Ala Asn Leu Glu Phe
    370   375   380

Pro Val Val Asp Gly Leu Asp Leu Trp Thr Thr Ile Asn Gln Lys Arg
385   390   395   400

Leu Val Pro Arg Ala Thr Gly Ala Lys Asp Glu Trp Ala Pro Ser Ser
                405   410   415

Phe Gly Glu Tyr Ala Gly Gln Leu Tyr Glu Lys Gln Ala Asn Phe Pro
                420   425   430

Gln Ile Val Glu Thr Ile Tyr Lys Gln Asn Tyr Asp Val Phe Val Glu
                435   440   445

Val Gly Pro Asn Asn His Arg Ser Thr Ala Val Arg Thr Thr Leu Gly
    450   455   460

Pro Gln Arg Asn His Leu Ala Gly Ala Ile Asp Lys Gln Asn Glu Asp
465   470   475   480

Ala Trp Thr Thr Ile Val Lys Leu Val Ala Ser Leu Lys Ala His Leu
                485   490   495

76

Val Pro Gly Val
            500

<210> 25
<211> 1530
<212> DNA
<213> Schizochytrium sp.

<220>
<221> CDS
<222> (1)..(1530)

<400> 25
ctg ctc gat ctc gac agt atg ctt gcg ctg agc tct gcc agt gcc tcc   48
Leu Leu Asp Leu Asp Ser Met Leu Ala Leu Ser Ser Ala Ser Ala Ser
1   5   10   15

ggc aac ctt gtt gag act gcg cct agc gac gcc tcg gtc att gtg ccg   96
Gly Asn Leu Val Glu Thr Ala Pro Ser Asp Ala Ser Val Ile Val Pro
                20   25   30

ccc tgc aac att gcg gat ctc ggc agc cgc gcc ttc atg aaa acg tac   144
Pro Cys Asn Ile Ala Asp Leu Gly Ser Arg Ala Phe Met Lys Thr Tyr
            35   40   45

ggt gtt tcg gcg cct ctg tac acg ggc gcc atg gcc aag ggc att gcc   192
Gly Val Ser Ala Pro Leu Tyr Thr Gly Ala Met Ala Lys Gly Ile Ala
        50   55   60

tct gcg gac ctc gtc att gcc gcc ggc cgc cag ggc atc ctt gcg tcc   240
Ser Ala Asp Leu Val Ile Ala Ala Gly Arg Gln Gly Ile Leu Ala Ser
65   70   75   80

ttt ggc gcc ggc gga ctt ccc atg cag gtt gtg cgt gag tcc atc gaa   288
Phe Gly Ala Gly Gly Leu Pro Met Gln Val Val Arg Glu Ser Ile Glu
                85   90   95

aag att cag gcc gcc ctg ccc aat ggc ccg tac gct gtc aac ctt atc   336
Lys Ile Gln Ala Ala Leu Pro Asn Gly Pro Tyr Ala Val Asn Leu Ile
            100   105   110

cat tct ccc ttt gac agc aac ctc gaa aag ggc aat gtc gat ctc ttc   384
His Ser Pro Phe Asp Ser Asn Leu Glu Lys Gly Asn Val Asp Leu Phe
            115   120   125

ctc gag aag ggt gtc acc ttt gtc gag gcc tcg gcc ttt atg acg ctc   432
Leu Glu Lys Gly Val Thr Phe Val Glu Ala Ser Ala Phe Met Thr Leu
        130   135   140

acc ccg cag gtc gtg cgg tac cgc gcg gct ggc ctc acg cgc aac gcc   480
Thr Pro Gln Val Val Arg Tyr Arg Ala Ala Gly Leu Thr Arg Asn Ala
145   150   155   160

gac ggc tcg gtc aac atc cgc aac cgt atc att ggc aag gtc tcg cgc   528
Asp Gly Ser Val Asn Ile Arg Asn Arg Ile Ile Gly Lys Val Ser Arg
                165   170   175

acc gag ctc gcc gag atg ttc atg cgt cct gcg ccc gag cac ctt ctt   576
Thr Glu Leu Ala Glu Met Phe Met Arg Pro Ala Pro Glu His Leu Leu
            180   185   190

cag aag ctc att gct tcc ggc gag atc aac cag gag cag gcc gag ctc   624
Gln Lys Leu Ile Ala Ser Gly Glu Ile Asn Gln Glu Gln Ala Glu Leu
            195   200   205

gcc cgc cgt gtt ccc gtc gct gac gac atc gcg gtc gaa gct gac tcg   672

77

```
Ala Arg Arg Val Pro Val Ala Asp Asp Ile Ala Val Glu Ala Asp Ser
    210              215              220

ggt ggc cac acc gac aac cgc ccc atc cac gtc att ctg ccc ctc atc    720
Gly Gly His Thr Asp Asn Arg Pro Ile His Val Ile Leu Pro Leu Ile
225              230              235              240

atc aac ctt cgc gac cgc ctt cac cgc gag tgc ggc tac ccg gcc aac    768
Ile Asn Leu Arg Asp Arg Leu His Arg Glu Cys Gly Tyr Pro Ala Asn
             245              250              255

ctt cgc gtc cgt gtg ggc gcc ggc ggt ggc att ggg tgc ccc cag gcg    816
Leu Arg Val Arg Val Gly Ala Gly Gly Gly Ile Gly Cys Pro Gln Ala
             260              265              270

gcg ctg gcc acc ttc aac atg ggt gcc tcc ttt att gtc acc ggc acc    864
Ala Leu Ala Thr Phe Asn Met Gly Ala Ser Phe Ile Val Thr Gly Thr
             275              280              285

gtg aac cag gtc gcc aag cag tcg ggc acg tgc gac aat gtg cgc aag    912
Val Asn Gln Val Ala Lys Gln Ser Gly Thr Cys Asp Asn Val Arg Lys
    290              295              300

cag ctc gcg aag gcc act tac tcg gac gta tgc atg gcc ccg gct gcc    960
Gln Leu Ala Lys Ala Thr Tyr Ser Asp Val Cys Met Ala Pro Ala Ala
305              310              315              320

gac atg ttc gag gaa ggc gtc aag ctt cag gtc ctc aag aag gga acc    1008
Asp Met Phe Glu Glu Gly Val Lys Leu Gln Val Leu Lys Lys Gly Thr
                 325              330              335

atg ttt ccc tcg cgc gcc aac aag ctc tac gag ctc ttt tgc aag tac    1056
Met Phe Pro Ser Arg Ala Asn Lys Leu Tyr Glu Leu Phe Cys Lys Tyr
             340              345              350

gac tcg ttc gag tcc atg ccc ccc gca gag ctt gcg cgc gtc gag aag    1104
Asp Ser Phe Glu Ser Met Pro Pro Ala Glu Leu Ala Arg Val Glu Lys
             355              360              365

cgc atc ttc agc cgc gcg ctc gaa gag gtc tgg gac gag acc aaa aac    1152
Arg Ile Phe Ser Arg Ala Leu Glu Glu Val Trp Asp Glu Thr Lys Asn
    370              375              380

ttt tac att aac cgt ctt cac aac ccg gag aag atc cag cgc gcc gag    1200
Phe Tyr Ile Asn Arg Leu His Asn Pro Glu Lys Ile Gln Arg Ala Glu
385              390              395              400

cgc gac ccc aag ctc aag atg tcg ctg tgc ttt cgc tgg tac ctg agc    1248
Arg Asp Pro Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Ser
                 405              410              415

ctg gcg agc cgc tgg gcc aac act gga gct tcc gat cgc gtc atg gac    1296
Leu Ala Ser Arg Trp Ala Asn Thr Gly Ala Ser Asp Arg Val Met Asp
             420              425              430

tac cag gtc tgg tgc ggt cct gcc att ggt tcc ttc aac gat ttc atc    1344
Tyr Gln Val Trp Cys Gly Pro Ala Ile Gly Ser Phe Asn Asp Phe Ile
         435              440              445

aag gga act tac ctt gat ccg gcc gtc gca aac gag tac ccg tgc gtc    1392
Lys Gly Thr Tyr Leu Asp Pro Ala Val Ala Asn Glu Tyr Pro Cys Val
    450              455              460

gtt cag att aac aag cag atc ctt cgt gga gcg tgc ttc ttg cgc cgt    1440
Val Gln Ile Asn Lys Gln Ile Leu Arg Gly Ala Cys Phe Leu Arg Arg
465              470              475              480

ctc gaa att ctg cgc aac gca cgc ctt tcc gat ggc gct gcc gct ctt    1488
```

78

```
Leu Glu Ile Leu Arg Asn Ala Arg Leu Ser Asp Gly Ala Ala Ala Leu
            485                 490                 495

gtg gcc agc atc gat gac aca tac gtc ccg gcc gag aag ctg                    1530
Val Ala Ser Ile Asp Asp Thr Tyr Val Pro Ala Glu Lys Leu
            500                 505                 510


<210>  26
<211>  510
<212>  PRT
<213>  Schizochytrium sp.

<400>  26

Leu Leu Asp Leu Asp Ser Met Leu Ala Leu Ser Ser Ala Ser Ala Ser
1               5                   10                  15


Gly Asn Leu Val Glu Thr Ala Pro Ser Asp Ala Ser Val Ile Val Pro
            20                  25                  30


Pro Cys Asn Ile Ala Asp Leu Gly Ser Arg Ala Phe Met Lys Thr Tyr
            35                  40                  45


Gly Val Ser Ala Pro Leu Tyr Thr Gly Ala Met Ala Lys Gly Ile Ala
            50                  55                  60


Ser Ala Asp Leu Val Ile Ala Ala Gly Arg Gln Gly Ile Leu Ala Ser
65                  70                  75                  80


Phe Gly Ala Gly Gly Leu Pro Met Gln Val Val Arg Glu Ser Ile Glu
                85                  90                  95


Lys Ile Gln Ala Ala Leu Pro Asn Gly Pro Tyr Ala Val Asn Leu Ile
            100                 105                 110


His Ser Pro Phe Asp Ser Asn Leu Glu Lys Gly Asn Val Asp Leu Phe
            115                 120                 125


Leu Glu Lys Gly Val Thr Phe Val Glu Ala Ser Ala Phe Met Thr Leu
    130                 135                 140


Thr Pro Gln Val Val Arg Tyr Arg Ala Ala Gly Leu Thr Arg Asn Ala
145                 150                 155                 160


Asp Gly Ser Val Asn Ile Arg Asn Arg Ile Ile Gly Lys Val Ser Arg
            165                 170                 175


Thr Glu Leu Ala Glu Met Phe Met Arg Pro Ala Pro Glu His Leu Leu
            180                 185                 190


Gln Lys Leu Ile Ala Ser Gly Glu Ile Asn Gln Glu Gln Ala Glu Leu
            195                 200                 205


Ala Arg Arg Val Pro Val Ala Asp Asp Ile Ala Val Glu Ala Asp Ser
```

79

```
Gly Gly His Thr Asp Asn Arg Pro Ile His Val Ile Leu Pro Leu Ile
225             230             235                     240

Ile Asn Leu Arg Asp Arg Leu His Arg Glu Cys Gly Tyr Pro Ala Asn
            245             250                 255

Leu Arg Val Arg Val Gly Ala Gly Gly Gly Ile Gly Cys Pro Gln Ala
            260             265                 270

Ala Leu Ala Thr Phe Asn Met Gly Ala Ser Phe Ile Val Thr Gly Thr
        275             280                 285

Val Asn Gln Val Ala Lys Gln Ser Gly Thr Cys Asp Asn Val Arg Lys
    290             295                 300

Gln Leu Ala Lys Ala Thr Tyr Ser Asp Val Cys Met Ala Pro Ala Ala
305             310             315                     320

Asp Met Phe Glu Glu Gly Val Lys Leu Gln Val Leu Lys Lys Gly Thr
            325             330                 335

Met Phe Pro Ser Arg Ala Asn Lys Leu Tyr Glu Leu Phe Cys Lys Tyr
            340             345                 350

Asp Ser Phe Glu Ser Met Pro Pro Ala Glu Leu Ala Arg Val Glu Lys
        355             360                 365

Arg Ile Phe Ser Arg Ala Leu Glu Glu Val Trp Asp Glu Thr Lys Asn
    370             375                 380

Phe Tyr Ile Asn Arg Leu His Asn Pro Glu Lys Ile Gln Arg Ala Glu
385             390             395                     400

Arg Asp Pro Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Ser
            405             410                 415

Leu Ala Ser Arg Trp Ala Asn Thr Gly Ala Ser Asp Arg Val Met Asp
            420             425                 430

Tyr Gln Val Trp Cys Gly Pro Ala Ile Gly Ser Phe Asn Asp Phe Ile
        435             440                 445

Lys Gly Thr Tyr Leu Asp Pro Ala Val Ala Asn Glu Tyr Pro Cys Val
    450             455                 460

Val Gln Ile Asn Lys Gln Ile Leu Arg Gly Ala Cys Phe Leu Arg Arg
465             470                 475                     480

Leu Glu Ile Leu Arg Asn Ala Arg Leu Ser Asp Gly Ala Ala Ala Leu
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Val Ala Ser Ile Asp Asp Thr Tyr Val Pro Ala Glu Lys Leu
          500   505   510

<210> 27
<211> 4512
<212> DNA
<213> Schizochytrium sp.

<220>
<221> CDS
<222> (1)..(4512)

<400> 27

atg gcg ctc cgt gtc aag acg aac aag aag cca tgc tgg gag atg acc | 48
Met Ala Leu Arg Val Lys Thr Asn Lys Lys Pro Cys Trp Glu Met Thr
1   5   10   15

aag gag gag ctg acc agc ggc aag acc gag gtg ttc aac tat gag gaa | 96
Lys Glu Glu Leu Thr Ser Gly Lys Thr Glu Val Phe Asn Tyr Glu Glu
              20   25   30

ctc ctc gag ttc gca gag ggc gac atc gcc aag gtc ttc gga ccc gag | 144
Leu Leu Glu Phe Ala Glu Gly Asp Ile Ala Lys Val Phe Gly Pro Glu
          35   40   45

ttc gcc gtc atc gac aag tac ccg cgc cgc gtg cgc ctg ccc gcc cgc | 192
Phe Ala Val Ile Asp Lys Tyr Pro Arg Arg Val Arg Leu Pro Ala Arg
      50   55   60

gag tac ctg ctc gtg acc cgc gtc acc ctc atg gac gcc gag gtc aac | 240
Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Asn
65   70   75   80

aac tac cgc gtc ggc gcc cgc atg gtc acc gag tac gat ctc ccc gtc | 288
Asn Tyr Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Leu Pro Val
                  85   90   95

aac gga gag ctc tcc gag ggc gga gac tgc ccc tgg gcc gtc ctg gtc | 336
Asn Gly Glu Leu Ser Glu Gly Gly Asp Cys Pro Trp Ala Val Leu Val
              100   105   110

gag agt ggc cag tgc gat ctc atg ctc atc tcc tac atg ggc att gac | 384
Glu Ser Gly Gln Cys Asp Leu Met Leu Ile Ser Tyr Met Gly Ile Asp
          115   120   125

ttc cag aac cag ggc gac cgc gtc tac cgc ctg ctc aac acc acg ctc | 432
Phe Gln Asn Gln Gly Asp Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu
      130   135   140

acc ttt tac ggc gtg gcc cac gag ggc gag acc ctc gag tac gac att | 480
Thr Phe Tyr Gly Val Ala His Glu Gly Glu Thr Leu Glu Tyr Asp Ile
145   150   155   160

cgc gtc acc ggc ttc gcc aag cgt ctc gac ggc ggc atc tcc atg ttc | 528
Arg Val Thr Gly Phe Ala Lys Arg Leu Asp Gly Gly Ile Ser Met Phe
                  165   170   175

ttc ttc gag tac gac tgc tac gtc aac ggc cgc ctc ctc atc gag atg | 576
Phe Phe Glu Tyr Asp Cys Tyr Val Asn Gly Arg Leu Leu Ile Glu Met
              180   185   190

cgc gat ggc tgc gcc ggc ttc ttc acc aac gag gag ctc gac gcc ggc | 624
Arg Asp Gly Cys Ala Gly Phe Phe Thr Asn Glu Glu Leu Asp Ala Gly

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aag ggc gtc gtc ttc acc cgc ggc gac ctc gcc gcc cgc gcc aag atc        672
Lys Gly Val Val Phe Thr Arg Gly Asp Leu Ala Ala Arg Ala Lys Ile
    210                 215                 220

cca aag cag gac gtc tcc ccc tac gcc gtc gcc ccc tgc ctc cac aag        720
Pro Lys Gln Asp Val Ser Pro Tyr Ala Val Ala Pro Cys Leu His Lys
225                 230                 235                 240

acc aag ctc aac gaa aag gag atg cag acc ctc gtc gac aag gac tgg        768
Thr Lys Leu Asn Glu Lys Glu Met Gln Thr Leu Val Asp Lys Asp Trp
                245                 250                 255

gca tcc gtc ttt ggc tcc aag aac ggc atg ccg gaa atc aac tac aaa        816
Ala Ser Val Phe Gly Ser Lys Asn Gly Met Pro Glu Ile Asn Tyr Lys
                260                 265                 270

ctc tgc gcg cgt aag atg ctc atg att gac cgc gtc acc agc att gac        864
Leu Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr Ser Ile Asp
        275                 280                 285

cac aag ggc ggt gtc tac ggc ctc ggt cag ctc gtc ggt gaa aag atc        912
His Lys Gly Gly Val Tyr Gly Leu Gly Gln Leu Val Gly Glu Lys Ile
    290                 295                 300

ctc gag cgc gac cac tgg tac ttt ccc tgc cac ttt gtc aag gat cag        960
Leu Glu Arg Asp His Trp Tyr Phe Pro Cys His Phe Val Lys Asp Gln
305                 310                 315                 320

gtc atg gcc gga tcc ctc gtc tcc gac ggc tgc agc cag atg ctc aag       1008
Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Met Leu Lys
                325                 330                 335

atg tac atg atc tgg ctc ggc ctc cac ctc acc acc gga ccc ttt gac       1056
Met Tyr Met Ile Trp Leu Gly Leu His Leu Thr Thr Gly Pro Phe Asp
                340                 345                 350

ttc cgc ccg gtc aac ggc cac ccc aac aag gtc cgc tgc cgc ggc caa       1104
Phe Arg Pro Val Asn Gly His Pro Asn Lys Val Arg Cys Arg Gly Gln
        355                 360                 365

atc tcc ccg cac aag ggc aag ctc gtc tac gtc atg gag atc aag gag       1152
Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Glu
    370                 375                 380

atg ggc ttc gac gag gac aac gac ccg tac gcc att gcc gac gtc aac       1200
Met Gly Phe Asp Glu Asp Asn Asp Pro Tyr Ala Ile Ala Asp Val Asn
385                 390                 395                 400

atc att gat gtc gac ttc gaa aag ggc cag gac ttt agc ctc gac cgc       1248
Ile Ile Asp Val Asp Phe Glu Lys Gly Gln Asp Phe Ser Leu Asp Arg
                405                 410                 415

atc agc gac tac ggc aag ggc gac ctc aac aag aag atc gtc gtc gac       1296
Ile Ser Asp Tyr Gly Lys Gly Asp Leu Asn Lys Lys Ile Val Val Asp
                420                 425                 430

ttt aag ggc atc gct ctc aag atg cag aag cgc tcc acc aac aag aac       1344
Phe Lys Gly Ile Ala Leu Lys Met Gln Lys Arg Ser Thr Asn Lys Asn
        435                 440                 445

ccc tcc aag gtt cag ccc gtc ttt gcc aac ggc gcc gcc act gtc ggc       1392
Pro Ser Lys Val Gln Pro Val Phe Ala Asn Gly Ala Ala Thr Val Gly
    450                 455                 460

ccc gag gcc tcc aag gct tcc tcc ggc gcc agc gcc agc gcc agc gcc       1440
Pro Glu Ala Ser Lys Ala Ser Ser Gly Ala Ser Ala Ser Ala Ser Ala
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                465                    470                    475                    480
gcc ccg gcc aag cct gcc ttc agc gcc gat gtt ctt gcg ccc aag ccc    1488
Ala Pro Ala Lys Pro Ala Phe Ser Ala Asp Val Leu Ala Pro Lys Pro
                485                    490                    495

gtt gcc ctt ccc gag cac atc ctc aag ggc gac gcc ctc gcc ccc aag    1536
Val Ala Leu Pro Glu His Ile Leu Lys Gly Asp Ala Leu Ala Pro Lys
            500                    505                    510

gag atg tcc tgg cac ccc atg gcc cgc atc ccg ggc aac ccg acg ccc    1584
Glu Met Ser Trp His Pro Met Ala Arg Ile Pro Gly Asn Pro Thr Pro
            515                    520                    525

tct ttt gcg ccc tcg gcc tac aag ccg cgc aac atc gcc ttt acg ccc    1632
Ser Phe Ala Pro Ser Ala Tyr Lys Pro Arg Asn Ile Ala Phe Thr Pro
        530                    535                    540

ttc ccc ggc aac ccc aac gat aac gac cac acc ccg ggc aag atg ccg    1680
Phe Pro Gly Asn Pro Asn Asp Asn Asp His Thr Pro Gly Lys Met Pro
545                    550                    555                    560

ctc acc tgg ttc aac atg gcc gag ttc atg gcc ggc aag gtc agc atg    1728
Leu Thr Trp Phe Asn Met Ala Glu Phe Met Ala Gly Lys Val Ser Met
                565                    570                    575

tgc ctc ggc ccc gag ttc gcc aag ttc gac gac tcg aac acc agc cgc    1776
Cys Leu Gly Pro Glu Phe Ala Lys Phe Asp Asp Ser Asn Thr Ser Arg
            580                    585                    590

agc ccc gct tgg gac ctc gct ctc gtc acc cgc gcc gtg tct gtg tct    1824
Ser Pro Ala Trp Asp Leu Ala Leu Val Thr Arg Ala Val Ser Val Ser
            595                    600                    605

gac ctc aag cac gtc aac tac cgc aac atc gac ctc gac ccc tcc aag    1872
Asp Leu Lys His Val Asn Tyr Arg Asn Ile Asp Leu Asp Pro Ser Lys
        610                    615                    620

ggt acc atg gtc ggc gag ttc gac tgc ccc gcg gac gcc tgg ttc tac    1920
Gly Thr Met Val Gly Glu Phe Asp Cys Pro Ala Asp Ala Trp Phe Tyr
625                    630                    635                    640

aag ggc gcc tgc aac gat gcc cac atg ccg tac tcg atc ctc atg gag    1968
Lys Gly Ala Cys Asn Asp Ala His Met Pro Tyr Ser Ile Leu Met Glu
                645                    650                    655

atc gcc ctc cag acc tcg ggt gtg ctc acc tcg gtg ctc aag gcg ccc    2016
Ile Ala Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu Lys Ala Pro
                660                    665                    670

ctg acc atg gag aag gac gac atc ctc ttc cgc aac ctc gac gcc aac    2064
Leu Thr Met Glu Lys Asp Asp Ile Leu Phe Arg Asn Leu Asp Ala Asn
            675                    680                    685

gcc gag ttc gtg cgc gcc gac ctc gac tac cgc ggc aag act atc cgc    2112
Ala Glu Phe Val Arg Ala Asp Leu Asp Tyr Arg Gly Lys Thr Ile Arg
        690                    695                    700

aac gtc acc aag tgc act ggc tac agc atg ctc ggc gag atg ggc gtc    2160
Asn Val Thr Lys Cys Thr Gly Tyr Ser Met Leu Gly Glu Met Gly Val
705                    710                    715                    720

cac cgc ttc acc ttt gag ctc tac gtc gat gat gtg ctc ttt tac aag    2208
His Arg Phe Thr Phe Glu Leu Tyr Val Asp Asp Val Leu Phe Tyr Lys
                725                    730                    735

ggc tcg acc tcg ttc ggc tgg ttc gtg ccc gag gtc ttt gcc gcc cag    2256
Gly Ser Thr Ser Phe Gly Trp Phe Val Pro Glu Val Phe Ala Ala Gln
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gcc ggc ctc gac aac ggc cgc aag tcg gag ccc tgg ttc att gag aac    2304
Ala Gly Leu Asp Asn Gly Arg Lys Ser Glu Pro Trp Phe Ile Glu Asn
        755                 760                 765

aag gtt ccg gcc tcg cag gtc tcc tcc ttt gac gtg cgc ccc aac ggc    2352
Lys Val Pro Ala Ser Gln Val Ser Ser Phe Asp Val Arg Pro Asn Gly
    770                 775                 780

agc ggc cgc acc gcc atc ttc gcc aac gcc ccc agc ggc gcc cag ctc    2400
Ser Gly Arg Thr Ala Ile Phe Ala Asn Ala Pro Ser Gly Ala Gln Leu
785                 790                 795                 800

aac cgc cgc acg gac cag ggc cag tac ctc gac gcc gtc gac att gtc    2448
Asn Arg Arg Thr Asp Gln Gly Gln Tyr Leu Asp Ala Val Asp Ile Val
            805                 810                 815

tcc ggc agc ggc aag aag agc ctc ggc tac gcc cac ggt tcc aag acg    2496
Ser Gly Ser Gly Lys Lys Ser Leu Gly Tyr Ala His Gly Ser Lys Thr
                820                 825                 830

gtc aac ccg aac gac tgg ttc ttc tcg tgc cac ttt tgg ttt gac tcg    2544
Val Asn Pro Asn Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp Ser
            835                 840                 845

gtc atg ccc gga agt ctc ggt gtc gag tcc atg ttc cag ctc gtc gag    2592
Val Met Pro Gly Ser Leu Gly Val Glu Ser Met Phe Gln Leu Val Glu
    850                 855                 860

gcc atc gcc gcc cac gag gat ctc gct ggc aaa gca cgg cat tgc caa    2640
Ala Ile Ala Ala His Glu Asp Leu Ala Gly Lys Ala Arg His Cys Gln
865                 870                 875                 880

ccc cac ctt tgt gca cgc ccc cgg gca aga tca agc tgg aag tac cgc    2688
Pro His Leu Cys Ala Arg Pro Arg Ala Arg Ser Ser Trp Lys Tyr Arg
                885                 890                 895

ggc cag ctc acg ccc aag agc aag aag atg gac tcg gag gtc cac atc    2736
Gly Gln Leu Thr Pro Lys Ser Lys Lys Met Asp Ser Glu Val His Ile
            900                 905                 910

gtg tcc gtg gac gcc cac gac ggc gtt gtc gac ctc gtc gcc gac ggc    2784
Val Ser Val Asp Ala His Asp Gly Val Val Asp Leu Val Ala Asp Gly
        915                 920                 925

ttc ctc tgg gcc gac agc ctc cgc gtc tac tcg gtg agc aac att cgc    2832
Phe Leu Trp Ala Asp Ser Leu Arg Val Tyr Ser Val Ser Asn Ile Arg
    930                 935                 940

gtg cgc atc gcc tcc ggt gag gcc cct gcc gcc gcc tcc tcc gcc gcc    2880
Val Arg Ile Ala Ser Gly Glu Ala Pro Ala Ala Ala Ser Ser Ala Ala
945                 950                 955                 960

tct gtg ggc tcc tcg gct tcg tcc gtc gag cgc acg cgc tcg agc ccc    2928
Ser Val Gly Ser Ser Ala Ser Ser Val Glu Arg Thr Arg Ser Ser Pro
                965                 970                 975

gct gtc gcc tcc ggc ccg gcc cag acc atc gac ctc aag cag ctc aag    2976
Ala Val Ala Ser Gly Pro Ala Gln Thr Ile Asp Leu Lys Gln Leu Lys
                980                 985                 990

acc gag ctc ctc gag ctc gat gcc  ccg ctc tac ctc tcg  cag gac ccg  3024
Thr Glu Leu Leu Glu Leu Asp Ala  Pro Leu Tyr Leu Ser  Gln Asp Pro
        995                 1000                1005

acc agc  ggc cag ctc aag aag  cac acc gac gtg gcc  tcc ggc cag    3069
Thr Ser  Gly Gln Leu Lys Lys  His Thr Asp Val Ala  Ser Gly Gln
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              1010                      1015                     1020

gcc acc atc gtg cag ccc tgc  acg ctc ggc gac ctc  ggt gac cgc          3114
Ala Thr Ile Val Gln Pro Cys  Thr Leu Gly Asp Leu  Gly Asp Arg
    1025                1030                1035

tcc ttc atg gag acc tac ggc  gtc gtc gcc ccg ctg  tac acg ggc          3159
Ser Phe Met Glu Thr Tyr Gly  Val Val Ala Pro Leu  Tyr Thr Gly
    1040                1045                1050

gcc atg gcc aag ggc att gcc  tcg gcg gac ctc gtc  atc gcc gcc          3204
Ala Met Ala Lys Gly Ile Ala  Ser Ala Asp Leu Val  Ile Ala Ala
    1055                1060                1065

ggc aag cgc aag atc ctc ggc  tcc ttt ggc gcc ggc  ggc ctc ccc          3249
Gly Lys Arg Lys Ile Leu Gly  Ser Phe Gly Ala Gly  Gly Leu Pro
    1070                1075                1080

atg cac cac gtg cgc gcc gcc  ctc gag aag atc cag  gcc gcc ctg          3294
Met His His Val Arg Ala Ala  Leu Glu Lys Ile Gln  Ala Ala Leu
    1085                1090                1095

cct cag ggc ccc tac gcc gtc  aac ctc atc cac tcg  cct ttt gac          3339
Pro Gln Gly Pro Tyr Ala Val  Asn Leu Ile His Ser  Pro Phe Asp
    1100                1105                1110

agc aac ctc gag aag ggc aac  gtc gat ctc ttc ctc  gag aag ggc          3384
Ser Asn Leu Glu Lys Gly Asn  Val Asp Leu Phe Leu  Glu Lys Gly
    1115                1120                1125

gtc act gtg gtg gag gcc tcg  gca ttc atg acc ctc  acc ccg cag          3429
Val Thr Val Val Glu Ala Ser  Ala Phe Met Thr Leu  Thr Pro Gln
    1130                1135                1140

gtc gtg cgc tac cgc gcc gcc  ggc ctc tcg cgc aac  gcc gac ggt          3474
Val Val Arg Tyr Arg Ala Ala  Gly Leu Ser Arg Asn  Ala Asp Gly
    1145                1150                1155

tcg gtc aac atc cgc aac cgc  atc atc ggc aag gtc  tcg cgc acc          3519
Ser Val Asn Ile Arg Asn Arg  Ile Ile Gly Lys Val  Ser Arg Thr
    1160                1165                1170

gag ctc gcc gag atg ttc atc  cgc ccg gcc ccg gag  cac ctc ctc          3564
Glu Leu Ala Glu Met Phe Ile  Arg Pro Ala Pro Glu  His Leu Leu
    1175                1180                1185

gag aag ctc atc gcc tcg ggc  gag atc acc cag gag  cag gcc gag          3609
Glu Lys Leu Ile Ala Ser Gly  Glu Ile Thr Gln Glu  Gln Ala Glu
    1190                1195                1200

ctc gcg cgc cgc gtt ccc gtc  gcc gac gat atc gct  gtc gag gct          3654
Leu Ala Arg Arg Val Pro Val  Ala Asp Asp Ile Ala  Val Glu Ala
    1205                1210                1215

gac tcg ggc ggc cac acc gac  aac cgc ccc atc cac  gtc atc ctc          3699
Asp Ser Gly Gly His Thr Asp  Asn Arg Pro Ile His  Val Ile Leu
    1220                1225                1230

ccg ctc atc atc aac ctc cgc  aac cgc ctg cac cgc  gag tgc ggc          3744
Pro Leu Ile Ile Asn Leu Arg  Asn Arg Leu His Arg  Glu Cys Gly
    1235                1240                1245

tac ccc gcg cac ctc cgc gtc  cgc gtt ggc gcc ggc  ggt ggc gtc          3789
Tyr Pro Ala His Leu Arg Val  Arg Val Gly Ala Gly  Gly Gly Val
    1250                1255                1260

ggc tgc ccg cag gcc gcc gcc  gcc gcg ctc acc atg  ggc gcc gcc          3834
Gly Cys Pro Gln Ala Ala Ala  Ala Ala Leu Thr Met  Gly Ala Ala
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85

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ttc atc gtc acc ggc act gtc  aac cag gtc gcc aag  cag tcc ggc       3879
Phe Ile Val Thr Gly Thr Val  Asn Gln Val Ala Lys  Gln Ser Gly
        1280             1285                1290

acc tgc gac aac gtg cgc aag  cag ctc tcg cag gcc  acc tac tcg       3924
Thr Cys Asp Asn Val Arg Lys  Gln Leu Ser Gln Ala  Thr Tyr Ser
        1295             1300                1305

gat atc tgc atg gcc ccg gcc  gcc gac atg ttc gag  gag ggc gtc       3969
Asp Ile Cys Met Ala Pro Ala  Ala Asp Met Phe Glu  Glu Gly Val
        1310             1315                1320

aag ctc cag gtc ctc aag aag  gga acc atg ttc ccc  tcg cgc gcc       4014
Lys Leu Gln Val Leu Lys Lys  Gly Thr Met Phe Pro  Ser Arg Ala
        1325             1330                1335

aac aag ctc tac gag ctc ttt  tgc aag tac gac tcc  ttc gac tcc       4059
Asn Lys Leu Tyr Glu Leu Phe  Cys Lys Tyr Asp Ser  Phe Asp Ser
        1340             1345                1350

atg cct cct gcc gag ctc gag  cgc atc gag aag cgt  atc ttc aag       4104
Met Pro Pro Ala Glu Leu Glu  Arg Ile Glu Lys Arg  Ile Phe Lys
        1355             1360                1365

cgc gca ctc cag gag gtc tgg  gag gag acc aag gac  ttt tac att       4149
Arg Ala Leu Gln Glu Val Trp  Glu Glu Thr Lys Asp  Phe Tyr Ile
        1370             1375                1380

aac ggt ctc aag aac ccg gag  aag atc cag cgc gcc  gag cac gac       4194
Asn Gly Leu Lys Asn Pro Glu  Lys Ile Gln Arg Ala  Glu His Asp
        1385             1390                1395

ccc aag ctc aag atg tcg ctc  tgc ttc cgc tgg tac  ctt ggt ctt       4239
Pro Lys Leu Lys Met Ser Leu  Cys Phe Arg Trp Tyr  Leu Gly Leu
        1400             1405                1410

gcc agc cgc tgg gcc aac atg  ggc gcc ccg gac cgc  gtc atg gac       4284
Ala Ser Arg Trp Ala Asn Met  Gly Ala Pro Asp Arg  Val Met Asp
        1415             1420                1425

tac cag gtc tgg tgt ggc ccg  gcc att ggc gcc ttc  aac gac ttc       4329
Tyr Gln Val Trp Cys Gly Pro  Ala Ile Gly Ala Phe  Asn Asp Phe
        1430             1435                1440

atc aag ggc acc tac ctc gac  ccc gct gtc tcc aac  gag tac ccc       4374
Ile Lys Gly Thr Tyr Leu Asp  Pro Ala Val Ser Asn  Glu Tyr Pro
        1445             1450                1455

tgt gtc gtc cag atc aac ctg  caa atc ctc cgt ggt  gcc tgc tac       4419
Cys Val Val Gln Ile Asn Leu  Gln Ile Leu Arg Gly  Ala Cys Tyr
        1460             1465                1470

ctg cgc cgt ctc aac gcc ctg  cgc aac gac ccg cgc  att gac ctc       4464
Leu Arg Arg Leu Asn Ala Leu  Arg Asn Asp Pro Arg  Ile Asp Leu
        1475             1480                1485

gag acc gag gat gct gcc ttt  gtc tac gag ccc acc  aac gcg ctc       4509
Glu Thr Glu Asp Ala Ala Phe  Val Tyr Glu Pro Thr  Asn Ala Leu
        1490             1495                1500

taa                                                                 4512
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<210>   28
<211>   1503
<212>   PRT

86

<213> Schizochytrium sp.

<400> 28

Met Ala Leu Arg Val Lys Thr Asn Lys Lys Pro Cys Trp Glu Met Thr
1   5   10   15

Lys Glu Glu Leu Thr Ser Gly Lys Thr Glu Val Phe Asn Tyr Glu Glu
                20   25   30

Leu Leu Glu Phe Ala Glu Gly Asp Ile Ala Lys Val Phe Gly Pro Glu
            35   40   45

Phe Ala Val Ile Asp Lys Tyr Pro Arg Arg Val Arg Leu Pro Ala Arg
        50   55   60

Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Asn
65   70   75   80

Asn Tyr Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Leu Pro Val
                85   90   95

Asn Gly Glu Leu Ser Glu Gly Gly Asp Cys Pro Trp Ala Val Leu Val
            100   105   110

Glu Ser Gly Gln Cys Asp Leu Met Leu Ile Ser Tyr Met Gly Ile Asp
        115   120   125

Phe Gln Asn Gln Gly Asp Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu
        130   135   140

Thr Phe Tyr Gly Val Ala His Glu Gly Glu Thr Leu Glu Tyr Asp Ile
145   150   155   160

Arg Val Thr Gly Phe Ala Lys Arg Leu Asp Gly Gly Ile Ser Met Phe
                165   170   175

Phe Phe Glu Tyr Asp Cys Tyr Val Asn Gly Arg Leu Leu Ile Glu Met
            180   185   190

Arg Asp Gly Cys Ala Gly Phe Phe Thr Asn Glu Glu Leu Asp Ala Gly
        195   200   205

Lys Gly Val Val Phe Thr Arg Gly Asp Leu Ala Ala Arg Ala Lys Ile
    210   215   220

Pro Lys Gln Asp Val Ser Pro Tyr Ala Val Ala Pro Cys Leu His Lys
225   230   235   240

Thr Lys Leu Asn Glu Lys Glu Met Gln Thr Leu Val Asp Lys Asp Trp
                245   250   255

Ala Ser Val Phe Gly Ser Lys Asn Gly Met Pro Glu Ile Asn Tyr Lys
        260   265   270

Leu Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr Ser Ile Asp
        275   280   285

His Lys Gly Gly Val Tyr Gly Leu Gly Gln Leu Val Gly Glu Lys Ile
    290   295   300

Leu Glu Arg Asp His Trp Tyr Phe Pro Cys His Phe Val Lys Asp Gln
305   310   315   320

Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Met Leu Lys
            325   330   335

Met Tyr Met Ile Trp Leu Gly Leu His Leu Thr Thr Gly Pro Phe Asp
            340   345   350

Phe Arg Pro Val Asn Gly His Pro Asn Lys Val Arg Cys Arg Gly Gln
        355   360   365

Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Glu
    370   375   380

Met Gly Phe Asp Glu Asp Asn Asp Pro Tyr Ala Ile Ala Asp Val Asn
385   390   395   400

Ile Ile Asp Val Asp Phe Glu Lys Gly Gln Asp Phe Ser Leu Asp Arg
            405   410   415

Ile Ser Asp Tyr Gly Lys Gly Asp Leu Asn Lys Lys Ile Val Val Asp
        420   425   430

Phe Lys Gly Ile Ala Leu Lys Met Gln Lys Arg Ser Thr Asn Lys Asn
        435   440   445

Pro Ser Lys Val Gln Pro Val Phe Ala Asn Gly Ala Ala Thr Val Gly
    450   455   460

Pro Glu Ala Ser Lys Ala Ser Ser Gly Ala Ser Ala Ser Ala Ser Ala
465   470   475   480

Ala Pro Ala Lys Pro Ala Phe Ser Ala Asp Val Leu Ala Pro Lys Pro
            485   490   495

Val Ala Leu Pro Glu His Ile Leu Lys Gly Asp Ala Leu Ala Pro Lys
        500   505   510

Glu Met Ser Trp His Pro Met Ala Arg Ile Pro Gly Asn Pro Thr Pro
        515   520   525

88

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Ser Phe Ala Pro Ser Ala Tyr Lys Pro Arg Asn Ile Ala Phe Thr Pro
    530             535             540

Phe Pro Gly Asn Pro Asn Asp Asn Asp His Thr Pro Gly Lys Met Pro
545             550             555             560

Leu Thr Trp Phe Asn Met Ala Glu Phe Met Ala Gly Lys Val Ser Met
                565             570             575

Cys Leu Gly Pro Glu Phe Ala Lys Phe Asp Asp Ser Asn Thr Ser Arg
            580             585             590

Ser Pro Ala Trp Asp Leu Ala Leu Val Thr Arg Ala Val Ser Val Ser
        595             600             605

Asp Leu Lys His Val Asn Tyr Arg Asn Ile Asp Leu Asp Pro Ser Lys
    610             615             620

Gly Thr Met Val Gly Glu Phe Asp Cys Pro Ala Asp Ala Trp Phe Tyr
625             630             635             640

Lys Gly Ala Cys Asn Asp Ala His Met Pro Tyr Ser Ile Leu Met Glu
            645             650             655

Ile Ala Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu Lys Ala Pro
            660             665             670

Leu Thr Met Glu Lys Asp Asp Ile Leu Phe Arg Asn Leu Asp Ala Asn
        675             680             685

Ala Glu Phe Val Arg Ala Asp Leu Asp Tyr Arg Gly Lys Thr Ile Arg
    690             695             700

Asn Val Thr Lys Cys Thr Gly Tyr Ser Met Leu Gly Glu Met Gly Val
705             710             715             720

His Arg Phe Thr Phe Glu Leu Tyr Val Asp Asp Val Leu Phe Tyr Lys
            725             730             735

Gly Ser Thr Ser Phe Gly Trp Phe Val Pro Glu Val Phe Ala Ala Gln
            740             745             750

Ala Gly Leu Asp Asn Gly Arg Lys Ser Glu Pro Trp Phe Ile Glu Asn
        755             760             765

Lys Val Pro Ala Ser Gln Val Ser Ser Phe Asp Val Arg Pro Asn Gly
    770             775             780

Ser Gly Arg Thr Ala Ile Phe Ala Asn Ala Pro Ser Gly Ala Gln Leu
785             790             795             800
```

Asn Arg Arg Thr Asp Gln Gly Gln Tyr Leu Asp Ala Val Asp Ile Val
            805   810   815

Ser Gly Ser Gly Lys Lys Ser Leu Gly Tyr Ala His Gly Ser Lys Thr
            820   825   830

Val Asn Pro Asn Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp Ser
            835   840   845

Val Met Pro Gly Ser Leu Gly Val Glu Ser Met Phe Gln Leu Val Glu
    850   855   860

Ala Ile Ala Ala His Glu Asp Leu Ala Gly Lys Ala Arg His Cys Gln
865   870   875   880

Pro His Leu Cys Ala Arg Pro Arg Ala Arg Ser Ser Trp Lys Tyr Arg
            885   890   895

Gly Gln Leu Thr Pro Lys Ser Lys Lys Met Asp Ser Glu Val His Ile
            900   905   910

Val Ser Val Asp Ala His Asp Gly Val Val Asp Leu Val Ala Asp Gly
            915   920   925

Phe Leu Trp Ala Asp Ser Leu Arg Val Tyr Ser Val Ser Asn Ile Arg
    930   935   940

Val Arg Ile Ala Ser Gly Glu Ala Pro Ala Ala Ala Ser Ser Ala Ala
945   950   955   960

Ser Val Gly Ser Ser Ala Ser Ser Val Glu Arg Thr Arg Ser Ser Pro
            965   970   975

Ala Val Ala Ser Gly Pro Ala Gln Thr Ile Asp Leu Lys Gln Leu Lys
            980   985   990

Thr Glu Leu Leu Glu Leu Asp Ala Pro Leu Tyr Leu Ser Gln Asp Pro
            995   1000   1005

Thr Ser Gly Gln Leu Lys Lys His Thr Asp Val Ala Ser Gly Gln
    1010   1015   1020

Ala Thr Ile Val Gln Pro Cys Thr Leu Gly Asp Leu Gly Asp Arg
    1025   1030   1035

Ser Phe Met Glu Thr Tyr Gly Val Val Ala Pro Leu Tyr Thr Gly
    1040   1045   1050

Ala Met Ala Lys Gly Ile Ala Ser Ala Asp Leu Val Ile Ala Ala
    1055   1060   1065

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Gly Lys  Arg Lys Ile Leu Gly  Ser Phe Gly Ala Gly  Gly Leu Pro
    1070             1075             1080

Met His  His Val Arg Ala Ala  Leu Glu Lys Ile Gln  Ala Ala Leu
    1085             1090             1095

Pro Gln  Gly Pro Tyr Ala Val  Asn Leu Ile His Ser  Pro Phe Asp
    1100             1105             1110

Ser Asn  Leu Glu Lys Gly Asn  Val Asp Leu Phe Leu  Glu Lys Gly
    1115             1120             1125

Val Thr  Val Val Glu Ala Ser  Ala Phe Met Thr Leu  Thr Pro Gln
    1130             1135             1140

Val Val  Arg Tyr Arg Ala Ala  Gly Leu Ser Arg Asn  Ala Asp Gly
    1145             1150             1155

Ser Val  Asn Ile Arg Asn Arg  Ile Ile Gly Lys Val  Ser Arg Thr
    1160             1165             1170

Glu Leu  Ala Glu Met Phe Ile  Arg Pro Ala Pro Glu  His Leu Leu
    1175             1180             1185

Glu Lys  Leu Ile Ala Ser Gly  Glu Ile Thr Gln Glu  Gln Ala Glu
    1190             1195             1200

Leu Ala  Arg Arg Val Pro Val  Ala Asp Asp Ile Ala  Val Glu Ala
    1205             1210             1215

Asp Ser  Gly Gly His Thr Asp  Asn Arg Pro Ile His  Val Ile Leu
    1220             1225             1230

Pro Leu  Ile Ile Asn Leu Arg  Asn Arg Leu His Arg  Glu Cys Gly
    1235             1240             1245

Tyr Pro  Ala His Leu Arg Val  Arg Val Gly Ala Gly  Gly Gly Val
    1250             1255             1260

Gly Cys  Pro Gln Ala Ala Ala  Ala Ala Leu Thr Met  Gly Ala Ala
    1265             1270             1275

Phe Ile  Val Thr Gly Thr Val  Asn Gln Val Ala Lys  Gln Ser Gly
    1280             1285             1290

Thr Cys  Asp Asn Val Arg Lys  Gln Leu Ser Gln Ala  Thr Tyr Ser
    1295             1300             1305

Asp Ile  Cys Met Ala Pro Ala  Ala Asp Met Phe Glu  Glu Gly Val
    1310             1315             1320
```

```
Lys Leu   Gln Val Leu Lys Lys   Gly Thr Met Phe Pro   Ser Arg Ala
    1325                1330                1335

Asn Lys   Leu Tyr Glu Leu Phe   Cys Lys Tyr Asp Ser   Phe Asp Ser
    1340                1345                1350

Met Pro   Pro Ala Glu Leu Glu   Arg Ile Glu Lys Arg   Ile Phe Lys
    1355                1360                1365

Arg Ala   Leu Gln Glu Val Trp   Glu Glu Thr Lys Asp   Phe Tyr Ile
    1370                1375                1380

Asn Gly   Leu Lys Asn Pro Glu   Lys Ile Gln Arg Ala   Glu His Asp
    1385                1390                1395

Pro Lys   Leu Lys Met Ser Leu   Cys Phe Arg Trp Tyr   Leu Gly Leu
    1400                1405                1410

Ala Ser   Arg Trp Ala Asn Met   Gly Ala Pro Asp Arg   Val Met Asp
    1415                1420                1425

Tyr Gln   Val Trp Cys Gly Pro   Ala Ile Gly Ala Phe   Asn Asp Phe
    1430                1435                1440

Ile Lys   Gly Thr Tyr Leu Asp   Pro Ala Val Ser Asn   Glu Tyr Pro
    1445                1450                1455

Cys Val   Val Gln Ile Asn Leu   Gln Ile Leu Arg Gly   Ala Cys Tyr
    1460                1465                1470

Leu Arg   Arg Leu Asn Ala Leu   Arg Asn Asp Pro Arg   Ile Asp Leu
    1475                1480                1485

Glu Thr   Glu Asp Ala Ala Phe   Val Tyr Glu Pro Thr   Asn Ala Leu
    1490                1495                1500


<210>   29
<211>   1500
<212>   DNA
<213>   Schizochytrium sp.


<220>
<221>   CDS
<222>   (1)..(1500)

<400>   29
aag gtt cag ccc gtc ttt gcc aac ggc gcc gcc act gtc ggc ccc gag        48
Lys Val Gln Pro Val Phe Ala Asn Gly Ala Ala Thr Val Gly Pro Glu
1               5                   10                  15

gcc tcc aag gct tcc tcc ggc gcc agc gcc agc gcc agc gcc gcc ccg        96
Ala Ser Lys Ala Ser Ser Gly Ala Ser Ala Ser Ala Ser Ala Ala Pro
                20                  25                  30

gcc aag cct gcc ttc agc gcc gat gtt ctt gcg ccc aag ccc gtt gcc       144
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```
Ala Lys Pro Ala Phe Ser Ala Asp Val Leu Ala Pro Lys Pro Val Ala
        35                  40                  45

ctt ccc gag cac atc ctc aag ggc gac gcc ctc gcc ccc aag gag atg     192
Leu Pro Glu His Ile Leu Lys Gly Asp Ala Leu Ala Pro Lys Glu Met
    50                  55                  60

tcc tgg cac ccc atg gcc cgc atc ccg ggc aac ccg acg ccc tct ttt     240
Ser Trp His Pro Met Ala Arg Ile Pro Gly Asn Pro Thr Pro Ser Phe
65                  70                  75                  80

gcg ccc tcg gcc tac aag ccg cgc aac atc gcc ttt acg ccc ttc ccc     288
Ala Pro Ser Ala Tyr Lys Pro Arg Asn Ile Ala Phe Thr Pro Phe Pro
                85                  90                  95

ggc aac ccc aac gat aac gac cac acc ccg ggc aag atg ccg ctc acc     336
Gly Asn Pro Asn Asp Asn Asp His Thr Pro Gly Lys Met Pro Leu Thr
                100                 105                 110

tgg ttc aac atg gcc gag ttc atg gcc ggc aag gtc agc atg tgc ctc     384
Trp Phe Asn Met Ala Glu Phe Met Ala Gly Lys Val Ser Met Cys Leu
            115                 120                 125

ggc ccc gag ttc gcc aag ttc gac gac tcg aac acc agc cgc agc ccc     432
Gly Pro Glu Phe Ala Lys Phe Asp Asp Ser Asn Thr Ser Arg Ser Pro
    130                 135                 140

gct tgg gac ctc gct ctc gtc acc cgc gcc gtg tct gtg tct gac ctc     480
Ala Trp Asp Leu Ala Leu Val Thr Arg Ala Val Ser Val Ser Asp Leu
145                 150                 155                 160

aag cac gtc aac tac cgc aac atc gac ctc gac ccc tcc aag ggt acc     528
Lys His Val Asn Tyr Arg Asn Ile Asp Leu Asp Pro Ser Lys Gly Thr
                165                 170                 175

atg gtc ggc gag ttc gac tgc ccc gcg gac gcc tgg ttc tac aag ggc     576
Met Val Gly Glu Phe Asp Cys Pro Ala Asp Ala Trp Phe Tyr Lys Gly
                180                 185                 190

gcc tgc aac gat gcc cac atg ccg tac tcg atc ctc atg gag atc gcc     624
Ala Cys Asn Asp Ala His Met Pro Tyr Ser Ile Leu Met Glu Ile Ala
            195                 200                 205

ctc cag acc tcg ggt gtg ctc acc tcg gtg ctc aag gcg ccc ctg acc     672
Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu Lys Ala Pro Leu Thr
    210                 215                 220

atg gag aag gac gac atc ctc ttc cgc aac ctc gac gcc aac gcc gag     720
Met Glu Lys Asp Asp Ile Leu Phe Arg Asn Leu Asp Ala Asn Ala Glu
225                 230                 235                 240

ttc gtg cgc gcc gac ctc gac tac cgc ggc aag act atc cgc aac gtc     768
Phe Val Arg Ala Asp Leu Asp Tyr Arg Gly Lys Thr Ile Arg Asn Val
                245                 250                 255

acc aag tgc act ggc tac agc atg ctc ggc gag atg ggc gtc cac cgc     816
Thr Lys Cys Thr Gly Tyr Ser Met Leu Gly Glu Met Gly Val His Arg
                260                 265                 270

ttc acc ttt gag ctc tac gtc gat gat gtg ctc ttt tac aag ggc tcg     864
Phe Thr Phe Glu Leu Tyr Val Asp Asp Val Leu Phe Tyr Lys Gly Ser
    275                 280                 285

acc tcg ttc ggc tgg ttc gtg ccc gag gtc ttt gcc gcc cag gcc ggc     912
Thr Ser Phe Gly Trp Phe Val Pro Glu Val Phe Ala Ala Gln Ala Gly
    290                 295                 300

ctc gac aac ggc cgc aag tcg gag ccc tgg ttc att gag aac aag gtt     960
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93

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Leu Asp Asn Gly Arg Lys Ser Glu Pro Trp Phe Ile Glu Asn Lys Val
305                 310             315             320

ccg gcc tcg cag gtc tcc tcc ttt gac gtg cgc ccc aac ggc agc ggc    1008
Pro Ala Ser Gln Val Ser Ser Phe Asp Val Arg Pro Asn Gly Ser Gly
                325             330             335

cgc acc gcc atc ttc gcc aac gcc ccc agc ggc gcc cag ctc aac cgc    1056
Arg Thr Ala Ile Phe Ala Asn Ala Pro Ser Gly Ala Gln Leu Asn Arg
                340             345             350

cgc acg gac cag ggc cag tac ctc gac gcc gtc gac att gtc tcc ggc    1104
Arg Thr Asp Gln Gly Gln Tyr Leu Asp Ala Val Asp Ile Val Ser Gly
            355             360             365

agc ggc aag aag agc ctc ggc tac gcc cac ggt tcc aag acg gtc aac    1152
Ser Gly Lys Lys Ser Leu Gly Tyr Ala His Gly Ser Lys Thr Val Asn
        370             375             380

ccg aac gac tgg ttc ttc tcg tgc cac ttt tgg ttt gac tcg gtc atg    1200
Pro Asn Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp Ser Val Met
385             390             395             400

ccc gga agt ctc ggt gtc gag tcc atg ttc cag ctc gtc gag gcc atc    1248
Pro Gly Ser Leu Gly Val Glu Ser Met Phe Gln Leu Val Glu Ala Ile
                405             410             415

gcc gcc cac gag gat ctc gct ggc aaa gca cgg cat tgc caa ccc cac    1296
Ala Ala His Glu Asp Leu Ala Gly Lys Ala Arg His Cys Gln Pro His
                420             425             430

ctt tgt gca cgc ccc cgg gca aga tca agc tgg aag tac cgc ggc cag    1344
Leu Cys Ala Arg Pro Arg Ala Arg Ser Ser Trp Lys Tyr Arg Gly Gln
            435             440             445

ctc acg ccc aag agc aag aag atg gac tcg gag gtc cac atc gtg tcc    1392
Leu Thr Pro Lys Ser Lys Lys Met Asp Ser Glu Val His Ile Val Ser
        450             455             460

gtg gac gcc cac gac ggc gtt gtc gac ctc gtc gcc gac ggc ttc ctc    1440
Val Asp Ala His Asp Gly Val Val Asp Leu Val Ala Asp Gly Phe Leu
465             470             475             480

tgg gcc gac agc ctc cgc gtc tac tcg gtg agc aac att cgc gtg cgc    1488
Trp Ala Asp Ser Leu Arg Val Tyr Ser Val Ser Asn Ile Arg Val Arg
            485             490             495

atc gcc tcc ggt                                                    1500
Ile Ala Ser Gly
            500


<210>   30
<211>   500
<212>   PRT
<213>   Schizochytrium sp.

<400>   30

Lys Val Gln Pro Val Phe Ala Asn Gly Ala Ala Thr Val Gly Pro Glu
1               5               10              15


Ala Ser Lys Ala Ser Ser Gly Ala Ser Ala Ser Ala Ser Ala Ala Pro
            20              25              30


Ala Lys Pro Ala Phe Ser Ala Asp Val Leu Ala Pro Lys Pro Val Ala
```

Leu Pro Glu His Ile Leu Lys Gly Asp Ala Leu Ala Pro Lys Glu Met
    50   55   60

Ser Trp His Pro Met Ala Arg Ile Pro Gly Asn Pro Thr Pro Ser Phe
65   70   75   80

Ala Pro Ser Ala Tyr Lys Pro Arg Asn Ile Ala Phe Thr Pro Phe Pro
                85   90   95

Gly Asn Pro Asn Asp Asn Asp His Thr Pro Gly Lys Met Pro Leu Thr
            100   105   110

Trp Phe Asn Met Ala Glu Phe Met Ala Gly Lys Val Ser Met Cys Leu
        115   120   125

Gly Pro Glu Phe Ala Lys Phe Asp Asp Ser Asn Thr Ser Arg Ser Pro
    130   135   140

Ala Trp Asp Leu Ala Leu Val Thr Arg Ala Val Ser Val Ser Asp Leu
145   150   155   160

Lys His Val Asn Tyr Arg Asn Ile Asp Leu Asp Pro Ser Lys Gly Thr
                165   170   175

Met Val Gly Glu Phe Asp Cys Pro Ala Asp Ala Trp Phe Tyr Lys Gly
            180   185   190

Ala Cys Asn Asp Ala His Met Pro Tyr Ser Ile Leu Met Glu Ile Ala
            195   200   205

Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu Lys Ala Pro Leu Thr
    210   215   220

Met Glu Lys Asp Asp Ile Leu Phe Arg Asn Leu Asp Ala Asn Ala Glu
225   230   235   240

Phe Val Arg Ala Asp Leu Asp Tyr Arg Gly Lys Thr Ile Arg Asn Val
            245   250   255

Thr Lys Cys Thr Gly Tyr Ser Met Leu Gly Glu Met Gly Val His Arg
            260   265   270

Phe Thr Phe Glu Leu Tyr Val Asp Asp Val Leu Phe Tyr Lys Gly Ser
        275   280   285

Thr Ser Phe Gly Trp Phe Val Pro Glu Val Phe Ala Ala Gln Ala Gly
    290   295   300

Leu Asp Asn Gly Arg Lys Ser Glu Pro Trp Phe Ile Glu Asn Lys Val

Pro Ala Ser Gln Val Ser Ser Phe Asp Val Arg Pro Asn Gly Ser Gly
                325   330   335

Arg Thr Ala Ile Phe Ala Asn Ala Pro Ser Gly Ala Gln Leu Asn Arg
                340   345   350

Arg Thr Asp Gln Gly Gln Tyr Leu Asp Ala Val Asp Ile Val Ser Gly
                355   360   365

Ser Gly Lys Lys Ser Leu Gly Tyr Ala His Gly Ser Lys Thr Val Asn
    370   375   380

Pro Asn Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp Ser Val Met
385   390   395   400

Pro Gly Ser Leu Gly Val Glu Ser Met Phe Gln Leu Val Glu Ala Ile
                405   410   415

Ala Ala His Glu Asp Leu Ala Gly Lys Ala Arg His Cys Gln Pro His
                420   425   430

Leu Cys Ala Arg Pro Arg Ala Arg Ser Ser Trp Lys Tyr Arg Gly Gln
    435   440   445

Leu Thr Pro Lys Ser Lys Lys Met Asp Ser Glu Val His Ile Val Ser
    450   455   460

Val Asp Ala His Asp Gly Val Val Asp Leu Val Ala Asp Gly Phe Leu
465   470   475   480

Trp Ala Asp Ser Leu Arg Val Tyr Ser Val Ser Asn Ile Arg Val Arg
                485   490   495

Ile Ala Ser Gly
                500

<210>   31
<211>   1512
<212>   DNA
<213>   Schizochytrium sp.

<220>
<221>   CDS
<222>   (1)..(1512)

<400>   31
gcc ccg ctc tac ctc tcg cag gac ccg acc agc ggc cag ctc aag aag   48
Ala Pro Leu Tyr Leu Ser Gln Asp Pro Thr Ser Gly Gln Leu Lys Lys
1   5   10   15

cac acc gac gtg gcc tcc ggc cag gcc acc atc gtg cag ccc tgc acg   96
His Thr Asp Val Ala Ser Gly Gln Ala Thr Ile Val Gln Pro Cys Thr

ctc ggc gac ctc ggt gac cgc tcc ttc atg gag acc tac ggc gtc gtc   144
Leu Gly Asp Leu Gly Asp Arg Ser Phe Met Glu Thr Tyr Gly Val Val
        35   40   45

gcc ccg ctg tac acg ggc gcc atg gcc aag ggc att gcc tcg gcg gac   192
Ala Pro Leu Tyr Thr Gly Ala Met Ala Lys Gly Ile Ala Ser Ala Asp
        50   55   60

ctc gtc atc gcc gcc ggc aag cgc aag atc ctc ggc tcc ttt ggc gcc   240
Leu Val Ile Ala Ala Gly Lys Arg Lys Ile Leu Gly Ser Phe Gly Ala
65   70   75   80

ggc ggc ctc ccc atg cac cac gtg cgc gcc gcc ctc gag aag atc cag   288
Gly Gly Leu Pro Met His His Val Arg Ala Ala Leu Glu Lys Ile Gln
                  85   90   95

gcc gcc ctg cct cag ggc ccc tac gcc gtc aac ctc atc cac tcg cct   336
Ala Ala Leu Pro Gln Gly Pro Tyr Ala Val Asn Leu Ile His Ser Pro
              100   105   110

ttt gac agc aac ctc gag aag ggc aac gtc gat ctc ttc ctc gag aag   384
Phe Asp Ser Asn Leu Glu Lys Gly Asn Val Asp Leu Phe Leu Glu Lys
              115   120   125

ggc gtc act gtg gtg gag gcc tcg gca ttc atg acc ctc acc ccg cag   432
Gly Val Thr Val Val Glu Ala Ser Ala Phe Met Thr Leu Thr Pro Gln
        130   135   140

gtc gtg cgc tac cgc gcc gcc ggc ctc tcg cgc aac gcc gac ggt tcg   480
Val Val Arg Tyr Arg Ala Ala Gly Leu Ser Arg Asn Ala Asp Gly Ser
145   150   155   160

gtc aac atc cgc aac cgc atc atc ggc aag gtc tcg cgc acc gag ctc   528
Val Asn Ile Arg Asn Arg Ile Ile Gly Lys Val Ser Arg Thr Glu Leu
                  165   170   175

gcc gag atg ttc atc cgc ccg gcc ccg gag cac ctc ctc gag aag ctc   576
Ala Glu Met Phe Ile Arg Pro Ala Pro Glu His Leu Leu Glu Lys Leu
              180   185   190

atc gcc tcg ggc gag atc acc cag gag cag gcc gag ctc gcg cgc cgc   624
Ile Ala Ser Gly Glu Ile Thr Gln Glu Gln Ala Glu Leu Ala Arg Arg
              195   200   205

gtt ccc gtc gcc gac gat atc gct gtc gag gct gac tcg ggc ggc cac   672
Val Pro Val Ala Asp Asp Ile Ala Val Glu Ala Asp Ser Gly Gly His
    210   215   220

acc gac aac cgc ccc atc cac gtc atc ctc ccg ctc atc atc aac ctc   720
Thr Asp Asn Arg Pro Ile His Val Ile Leu Pro Leu Ile Ile Asn Leu
225   230   235   240

cgc aac cgc ctg cac cgc gag tgc ggc tac ccc gcg cac ctc cgc gtc   768
Arg Asn Arg Leu His Arg Glu Cys Gly Tyr Pro Ala His Leu Arg Val
                  245   250   255

cgc gtt ggc gcc ggc ggt ggc gtc ggc tgc ccg cag gcc gcc gcc gcc   816
Arg Val Gly Ala Gly Gly Gly Val Gly Cys Pro Gln Ala Ala Ala Ala
              260   265   270

gcg ctc acc atg ggc gcc gcc ttc atc gtc acc ggc act gtc aac cag   864
Ala Leu Thr Met Gly Ala Ala Phe Ile Val Thr Gly Thr Val Asn Gln
        275   280   285

gtc gcc aag cag tcc ggc acc tgc gac aac gtg cgc aag cag ctc tcg   912
Val Ala Lys Gln Ser Gly Thr Cys Asp Asn Val Arg Lys Gln Leu Ser

```
cag gcc acc tac tcg gat atc tgc atg gcc ccg gcc gcc gac atg ttc       960
Gln Ala Thr Tyr Ser Asp Ile Cys Met Ala Pro Ala Ala Asp Met Phe
305                 310             315                 320

gag gag ggc gtc aag ctc cag gtc ctc aag aag gga acc atg ttc ccc      1008
Glu Glu Gly Val Lys Leu Gln Val Leu Lys Lys Gly Thr Met Phe Pro
                325             330             335

tcg cgc gcc aac aag ctc tac gag ctc ttt tgc aag tac gac tcc ttc      1056
Ser Arg Ala Asn Lys Leu Tyr Glu Leu Phe Cys Lys Tyr Asp Ser Phe
                340             345             350

gac tcc atg cct cct gcc gag ctc gag cgc atc gag aag cgt atc ttc      1104
Asp Ser Met Pro Pro Ala Glu Leu Glu Arg Ile Glu Lys Arg Ile Phe
            355             360             365

aag cgc gca ctc cag gag gtc tgg gag gag acc aag gac ttt tac att      1152
Lys Arg Ala Leu Gln Glu Val Trp Glu Glu Thr Lys Asp Phe Tyr Ile
    370             375             380

aac ggt ctc aag aac ccg gag aag atc cag cgc gcc gag cac gac ccc      1200
Asn Gly Leu Lys Asn Pro Glu Lys Ile Gln Arg Ala Glu His Asp Pro
385             390             395             400

aag ctc aag atg tcg ctc tgc ttc cgc tgg tac ctt ggt ctt gcc agc      1248
Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Gly Leu Ala Ser
            405             410             415

cgc tgg gcc aac atg ggc gcc ccg gac cgc gtc atg gac tac cag gtc      1296
Arg Trp Ala Asn Met Gly Ala Pro Asp Arg Val Met Asp Tyr Gln Val
            420             425             430

tgg tgt ggc ccg gcc att ggc gcc ttc aac gac ttc atc aag ggc acc      1344
Trp Cys Gly Pro Ala Ile Gly Ala Phe Asn Asp Phe Ile Lys Gly Thr
            435             440             445

tac ctc gac ccc gct gtc tcc aac gag tac ccc tgt gtc gtc cag atc      1392
Tyr Leu Asp Pro Ala Val Ser Asn Glu Tyr Pro Cys Val Val Gln Ile
    450             455             460

aac ctg caa atc ctc cgt ggt gcc tgc tac ctg cgc cgt ctc aac gcc      1440
Asn Leu Gln Ile Leu Arg Gly Ala Cys Tyr Leu Arg Arg Leu Asn Ala
465             470             475             480

ctg cgc aac gac ccg cgc att gac ctc gag acc gag gat gct gcc ttt      1488
Leu Arg Asn Asp Pro Arg Ile Asp Leu Glu Thr Glu Asp Ala Ala Phe
            485             490             495

gtc tac gag ccc acc aac gcg ctc                                      1512
Val Tyr Glu Pro Thr Asn Ala Leu
            500
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<210>   32
<211>   504
<212>   PRT
<213>   Schizochytrium sp.

<400>   32

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Ala Pro Leu Tyr Leu Ser Gln Asp Pro Thr Ser Gly Gln Leu Lys Lys
1                5                   10              15

His Thr Asp Val Ala Ser Gly Gln Ala Thr Ile Val Gln Pro Cys Thr
            20              25              30
```

Leu Gly Asp Leu Gly Asp Arg Ser Phe Met Glu Thr Tyr Gly Val Val
        35   40   45

Ala Pro Leu Tyr Thr Gly Ala Met Ala Lys Gly Ile Ala Ser Ala Asp
    50   55   60

Leu Val Ile Ala Ala Gly Lys Arg Lys Ile Leu Gly Ser Phe Gly Ala
65   70   75   80

Gly Gly Leu Pro Met His His Val Arg Ala Ala Leu Glu Lys Ile Gln
            85   90   95

Ala Ala Leu Pro Gln Gly Pro Tyr Ala Val Asn Leu Ile His Ser Pro
            100   105   110

Phe Asp Ser Asn Leu Glu Lys Gly Asn Val Asp Leu Phe Leu Glu Lys
        115   120   125

Gly Val Thr Val Val Glu Ala Ser Ala Phe Met Thr Leu Thr Pro Gln
    130   135   140

Val Val Arg Tyr Arg Ala Ala Gly Leu Ser Arg Asn Ala Asp Gly Ser
145   150   155   160

Val Asn Ile Arg Asn Arg Ile Ile Gly Lys Val Ser Arg Thr Glu Leu
            165   170   175

Ala Glu Met Phe Ile Arg Pro Ala Pro Glu His Leu Leu Glu Lys Leu
            180   185   190

Ile Ala Ser Gly Glu Ile Thr Gln Glu Gln Ala Glu Leu Ala Arg Arg
            195   200   205

Val Pro Val Ala Asp Asp Ile Ala Val Glu Ala Asp Ser Gly Gly His
    210   215   220

Thr Asp Asn Arg Pro Ile His Val Ile Leu Pro Leu Ile Ile Asn Leu
225   230   235   240

Arg Asn Arg Leu His Arg Glu Cys Gly Tyr Pro Ala His Leu Arg Val
            245   250   255

Arg Val Gly Ala Gly Gly Gly Val Gly Cys Pro Gln Ala Ala Ala Ala
            260   265   270

Ala Leu Thr Met Gly Ala Ala Phe Ile Val Thr Gly Thr Val Asn Gln
    275   280   285

Val Ala Lys Gln Ser Gly Thr Cys Asp Asn Val Arg Lys Gln Leu Ser
    290   295   300

99

```
Gln Ala Thr Tyr Ser Asp Ile Cys Met Ala Pro Ala Ala Asp Met Phe
305             310             315             320

Glu Glu Gly Val Lys Leu Gln Val Leu Lys Lys Gly Thr Met Phe Pro
                325             330             335

Ser Arg Ala Asn Lys Leu Tyr Glu Leu Phe Cys Lys Tyr Asp Ser Phe
                340             345             350

Asp Ser Met Pro Pro Ala Glu Leu Glu Arg Ile Glu Lys Arg Ile Phe
        355             360             365

Lys Arg Ala Leu Gln Glu Val Trp Glu Glu Thr Lys Asp Phe Tyr Ile
    370             375             380

Asn Gly Leu Lys Asn Pro Glu Lys Ile Gln Arg Ala Glu His Asp Pro
385             390             395             400

Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Gly Leu Ala Ser
            405             410             415

Arg Trp Ala Asn Met Gly Ala Pro Asp Arg Val Met Asp Tyr Gln Val
            420             425             430

Trp Cys Gly Pro Ala Ile Gly Ala Phe Asn Asp Phe Ile Lys Gly Thr
            435             440             445

Tyr Leu Asp Pro Ala Val Ser Asn Glu Tyr Pro Cys Val Val Gln Ile
    450             455             460

Asn Leu Gln Ile Leu Arg Gly Ala Cys Tyr Leu Arg Arg Leu Asn Ala
465             470             475             480

Leu Arg Asn Asp Pro Arg Ile Asp Leu Glu Thr Glu Asp Ala Ala Phe
                485             490             495

Val Tyr Glu Pro Thr Asn Ala Leu
            500


<210>   33
<211>   9
<212>   PRT
<213>   Artificial sequence

<220>
<223>   motif


<220>
<221>   MISC_FEATURE
<222>   (2)..(3)
<223>   Xaa = any amino acid

<220>
<221>   MISC_FEATURE
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<222>   (6)..(6)
<223>   Xaa = Ala or Ser

<220>
<221>   MISC_FEATURE
<222>   (7)..(8)
<223>   Xaa = any amino acid

<400>   33

Trp Xaa Xaa Lys Glu Xaa Xaa Xaa Lys
1               5


<210>   34
<211>   6
<212>   PRT
<213>   Artificial sequence

<220>
<223>   motif


<220>
<221>   MISC_FEATURE
<222>   (1)..(6)
<223>   Xaa = Ile or Leu or Val

<400>   34

Phe Asn Xaa Ser His Ser
1               5


<210>   35
<211>   5
<212>   PRT
<213>   Artificial sequence

<220>
<223>   motif


<220>
<221>   MISC_FEATURE
<222>   (1)..(5)
<223>   Xaa = Ile or Leu or Val

<400>   35

Xaa Gly Xaa Asp Xaa
1               5


<210>   36
<211>   4244
<212>   DNA
<213>   Schizochytrium sp.

<400>   36
tttctctctc tcgagctgtt gctgctgctg ctgctgctgc tgcttccttg ctggttctca      60

cgtccgttcg atcaagcgct cgctcgctcg accgatcggt gcgtgcgtgc gtgcgtgagt     120

cttgttgcca ggcagccgca ggctgtctgt ctgtttgtgt agttttaccc tcggggttcg     180

gggtctgcct gcctcccgct cccgcccgcc gccgcccgta tccaccccgc tcgcctccgc     240
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ccatcgggcc tcgcctcctc gcgccgcacg catcgcgcgc atcgcatgca tcatgctgcc    300

acgcacgggg ggacgcgcgc cccgcgtccc ccgccgccgc cgtcgtcgtc tggcgatgcc    360

gtcgccgccc tccttccttc cctcgcctcc tcttcctccc gagcccccct gtcttccttc    420

gcccccgcag cggcgcgcag gaagcgagga gagcggggag gagagaagaa aagaaaagaa    480

aagaaaagaa aataacagcg ccgtctcgcg cagacgcgcg cggccgcgtg cgaggcggcg    540

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102

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cac ttg cct tgt ggg aca gat gtg aag gaa tca tgg cag gct att cgc   96
His Leu Pro Cys Gly Thr Asp Val Lys Glu Ser Trp Gln Ala Ile Arg
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gat gga atc gac tgt cta agt gac cta ccc gcg gat cgt ctc gac gtt   144
Asp Gly Ile Asp Cys Leu Ser Asp Leu Pro Ala Asp Arg Leu Asp Val
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aca gct tac tac aat ccc aac aaa gcc acg aaa gac aag atc tac tgc   192
Thr Ala Tyr Tyr Asn Pro Asn Lys Ala Thr Lys Asp Lys Ile Tyr Cys
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aaa cgg ggt ggc ttc atc ccg aac tat gac ttc gac ccc cgc gaa ttt   240
Lys Arg Gly Gly Phe Ile Pro Asn Tyr Asp Phe Asp Pro Arg Glu Phe
65   70   75   80

ggg ctc aac atg ttt caa atg gaa gac tct gat gcg aat cag aca ctt   288
Gly Leu Asn Met Phe Gln Met Glu Asp Ser Asp Ala Asn Gln Thr Leu
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acc ttg ctc aaa gtc aaa caa gct ctc gaa gat gca agc ata gag cct   336
Thr Leu Leu Lys Val Lys Gln Ala Leu Glu Asp Ala Ser Ile Glu Pro
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Phe Thr Lys Glu Lys Lys Asn Ile Gly Cys Val Leu Gly Ile Gly Gly
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Gly Gln Lys Ala Ser His Glu Phe Tyr Ser Arg Leu Asn Tyr Val Val
    130   135   140

gtt gaa aag gta ctt cgg aaa atg ggt tta cca gat gct gat gtt gaa   480
Val Glu Lys Val Leu Arg Lys Met Gly Leu Pro Asp Ala Asp Val Glu
145   150   155   160

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Glu Ala Val Glu Lys Tyr Lys Ala Asn Phe Pro Glu Trp Arg Leu Asp
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Ser Phe Pro Gly Phe Leu Gly Asn Val Thr Ala Gly Arg Cys Ser Asn
            180   185   190

acc ttc aac atg gaa ggt atg aac tgc gtt gtg gat gct gca tgt gcc   624
Thr Phe Asn Met Glu Gly Met Asn Cys Val Val Asp Ala Ala Cys Ala
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106

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Asp Cys Asp Thr Met Ile Ala Gly Ala Thr Cys Thr Asp Asn Ser Leu
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Gly Met Tyr Met Ala Phe Ser Lys Thr Pro Val Phe Ser Thr Asp Pro
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agt gtc cgc gcg tat gat gag aaa aca aaa ggg atg cta att gga gaa        816
Ser Val Arg Ala Tyr Asp Glu Lys Thr Lys Gly Met Leu Ile Gly Glu
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ggt tca gca atg ttc gtt ctt aaa cgc tat gcg gat gcc gta cgt gat        864
Gly Ser Ala Met Phe Val Leu Lys Arg Tyr Ala Asp Ala Val Arg Asp
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Gly Asp Thr Ile His Ala Val Leu Arg Ser Cys Ser Ser Ser Ser Asp
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gga aaa gcg gca gga att tat act cct act ata tct gga caa gaa gaa        960
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305             310             315             320

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Gly Leu Val Glu Gly His Gly Thr Gly Thr Pro Val Gly Asp Arg Ile
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Glu Leu Thr Ala Leu Arg Asn Leu Phe Asp Lys Ala Phe Gly Ser Lys
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aag gaa caa ata gca gtt ggc agc ata aag tct cag ata ggt cac ctg       1152
Lys Glu Gln Ile Ala Val Gly Ser Ile Lys Ser Gln Ile Gly His Leu
    370             375             380

aaa tct gtt gcc ggc ttt gcc ggc ttg gtc aaa gct gtg ctt gcg ctt       1200
Lys Ser Val Ala Gly Phe Ala Gly Leu Val Lys Ala Val Leu Ala Leu
385             390             395             400

aaa cac aaa acg ctc cca ggt tcg att aat gtc gac cag cca cct ttg       1248
Lys His Lys Thr Leu Pro Gly Ser Ile Asn Val Asp Gln Pro Pro Leu
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ttg tat gac ggt act caa att caa gac tct tct tta tat atc aac aag       1296
Leu Tyr Asp Gly Thr Gln Ile Gln Asp Ser Ser Leu Tyr Ile Asn Lys
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aca aat aga cca tgg ttt acg caa aac aag ctt ccg cgt cgg gct ggt       1344
Thr Asn Arg Pro Trp Phe Thr Gln Asn Lys Leu Pro Arg Arg Ala Gly
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gtc tca agt ttt gga ttt gga ggt gca aac tac cac gcg gtt ctg gaa       1392
Val Ser Ser Phe Gly Phe Gly Gly Ala Asn Tyr His Ala Val Leu Glu
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His Pro Val Leu Leu Tyr Ala Pro Ser Val Glu Ala Leu Lys Val Leu
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Cys Asn Asp Gln Leu Ala Glu Leu Thr Ile Ala Leu Glu Glu Ala Lys
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Thr His Lys Asn Val Asp Lys Val Cys Gly Tyr Lys Phe Ile Asp Glu
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His Lys Lys Ala Phe Gly Ala Thr Phe Ala Ser Ser Ser Val Lys Gly
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Phe Ser Asp Val Ala Met Asn Trp Pro Pro Phe Arg Asp Ser Ile Val
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Ile Ser Lys Val Leu Phe Pro Arg Glu Arg Tyr Ala Ser Glu Ser Glu
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Gln Gly Asn Glu Leu Leu Cys Leu Thr Glu Tyr Ser Gln Pro Thr Thr
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Lys Pro Asp Met Val Gly Gly His Ser Leu Gly Glu Phe Ala Ala Leu
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Val Gln Gly Val Lys Glu Glu Ser Lys Leu Leu Ile Ser Lys Gly Phe
        770                 775                 780

cgc gta ctg cca ctt aaa tgc cag ggc gcc ttc cat tct cct ttg atg        2400
Arg Val Leu Pro Leu Lys Cys Gln Gly Ala Phe His Ser Pro Leu Met
785                 790                 795                 800

ggg cct tct gag gat agt ttc aaa tca ctt gtg gag act tgt acc atc        2448
Gly Pro Ser Glu Asp Ser Phe Lys Ser Leu Val Glu Thr Cys Thr Ile
                805                 810                 815

tcg ccg cca aaa aat gtg aaa ttc ttt tgc aat gtt agt ggc aag gaa        2496
Ser Pro Pro Lys Asn Val Lys Phe Phe Cys Asn Val Ser Gly Lys Glu
            820                 825                 830

agc cca aac cca aaa cag acc ctc aag tca cac atg acg tct agc gtt        2544
Ser Pro Asn Pro Lys Gln Thr Leu Lys Ser His Met Thr Ser Ser Val
            835                 840                 845

cag ttc gag gag cag att cgt aac atg tac gat gcc gga gca cgt gtt        2592
Gln Phe Glu Glu Gln Ile Arg Asn Met Tyr Asp Ala Gly Ala Arg Val
        850                 855                 860

ttt ctg gag ttt gga ccc cgc caa gtc ctt gca aag ctt atc gcg gaa        2640
Phe Leu Glu Phe Gly Pro Arg Gln Val Leu Ala Lys Leu Ile Ala Glu
865                 870                 875                 880

atg ttt ccc tcg tgt aca gct atc agc gtt aac ccc gcg agc agt ggt        2688
Met Phe Pro Ser Cys Thr Ala Ile Ser Val Asn Pro Ala Ser Ser Gly
                885                 890                 895

gac agt gac gtg caa ctc cgc ctc gcc gcc gta aaa ttc gcg gtc tcg        2736
Asp Ser Asp Val Gln Leu Arg Leu Ala Ala Val Lys Phe Ala Val Ser
                900                 905                 910

ggt gca gcc ctt agc acc ttt gat cca tgg gag tat cgc aag cca caa        2784
Gly Ala Ala Leu Ser Thr Phe Asp Pro Trp Glu Tyr Arg Lys Pro Gln
            915                 920                 925

gat ctt ctt att cga aaa cca cga aaa act gcc ctt gtt cta tca gca        2832
Asp Leu Leu Ile Arg Lys Pro Arg Lys Thr Ala Leu Val Leu Ser Ala
        930                 935                 940

gca aca tat gtt tcc cca aag act ctt gca gaa cgt aaa aag gct atg        2880
Ala Thr Tyr Val Ser Pro Lys Thr Leu Ala Glu Arg Lys Lys Ala Met
945                 950                 955                 960

gaa gat atc aag cta gta tcc att aca cca aga gat agt atg gta tca        2928
Glu Asp Ile Lys Leu Val Ser Ile Thr Pro Arg Asp Ser Met Val Ser
                965                 970                 975

att gga aaa atc gcg caa gaa gta cgg aca gct aaa cag cct tta gaa        2976
Ile Gly Lys Ile Ala Gln Glu Val Arg Thr Ala Lys Gln Pro Leu Glu
                980                 985                 990

acc gaa att cga aga ctc aac aaa  gaa tta gaa cat ctc  aag aga gag     3024
Thr Glu Ile Arg Arg Leu Asn Lys  Glu Leu Glu His Leu  Lys Arg Glu
            995                 1000                1005

cta gca  gca gcc aaa gcg agt  gtc aag tct gca tca  aaa agc tct        3069
Leu Ala  Ala Ala Lys Ala Ser  Val Lys Ser Ala Ser  Lys Ser Ser
    1010                1015                1020
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109

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aaa gag cga tct gtc cta tca   aag cac cgc gct ttg   ctt caa aac         3114
Lys Glu Arg Ser Val Leu Ser   Lys His Arg Ala Leu   Leu Gln Asn
    1025                1030                 1035

att ttg caa gac tac gat gat   ctt cgt gtg gtg cca   ttc gct gtt         3159
Ile Leu Gln Asp Tyr Asp Asp   Leu Arg Val Val Pro   Phe Ala Val
    1040                1045                 1050

cgt tct gtt gca gtg gac aac   acc gcg ccg tat gct   gac caa gtt         3204
Arg Ser Val Ala Val Asp Asn   Thr Ala Pro Tyr Ala   Asp Gln Val
    1055                1060                 1065

tcg acc cca gcg tca gag cgg   tcg gct tca ccg ctt   ttc gag aaa         3249
Ser Thr Pro Ala Ser Glu Arg   Ser Ala Ser Pro Leu   Phe Glu Lys
    1070                1075                 1080

cgc agt tcg gtt tcg tca gca   cgc ctc gct gaa gct   gaa gcc gcg         3294
Arg Ser Ser Val Ser Ser Ala   Arg Leu Ala Glu Ala   Glu Ala Ala
    1085                1090                 1095

gta ctg agc gtt ctc gca gac   aag aca ggc tac gac   agc tca atg         3339
Val Leu Ser Val Leu Ala Asp   Lys Thr Gly Tyr Asp   Ser Ser Met
    1100                1105                 1110

atc gag atg gac atg gac ctg   gag agt gag ctt ggc   gtt gat agc         3384
Ile Glu Met Asp Met Asp Leu   Glu Ser Glu Leu Gly   Val Asp Ser
    1115                1120                 1125

atc aaa cgc gtg gag atc atg   agc gag gtt caa acg   ctg ctc agc         3429
Ile Lys Arg Val Glu Ile Met   Ser Glu Val Gln Thr   Leu Leu Ser
    1130                1135                 1140

gtg gaa gtc tcc gac gtt gac   gct ctg tca aga acc   aag act gtt         3474
Val Glu Val Ser Asp Val Asp   Ala Leu Ser Arg Thr   Lys Thr Val
    1145                1150                 1155

ggc gac gtc atc gag gcg atg   aag ctg gaa ctc ggt   gga ccc caa         3519
Gly Asp Val Ile Glu Ala Met   Lys Leu Glu Leu Gly   Gly Pro Gln
    1160                1165                 1170

ggc cag act ttg acc gcg gaa   tcg atc cgt cag cca   ccg gtg tcc         3564
Gly Gln Thr Leu Thr Ala Glu   Ser Ile Arg Gln Pro   Pro Val Ser
    1175                1180                 1185

gag cct gct gta ccg acc tca   tcg tca agc agt att   gct aat gtt         3609
Glu Pro Ala Val Pro Thr Ser   Ser Ser Ser Ser Ile   Ala Asn Val
    1190                1195                 1200

tcg tca gca cgc ctc gct gaa   gct gaa gct gcg gta   ctg agc gtt         3654
Ser Ser Ala Arg Leu Ala Glu   Ala Glu Ala Ala Val   Leu Ser Val
    1205                1210                 1215

ctc gca gac aag aca ggc tac   gac agc tca atg atc   gag atg gac         3699
Leu Ala Asp Lys Thr Gly Tyr   Asp Ser Ser Met Ile   Glu Met Asp
    1220                1225                 1230

atg gac ctg gag agc gag ctt   ggc gtt gat agc atc   aaa cgc gtg         3744
Met Asp Leu Glu Ser Glu Leu   Gly Val Asp Ser Ile   Lys Arg Val
    1235                1240                 1245

gag atc atg agc gag gtt caa   acg ctg ctc agc gtg   gaa gtc tcc         3789
Glu Ile Met Ser Glu Val Gln   Thr Leu Leu Ser Val   Glu Val Ser
    1250                1255                 1260

gac gtt gac gct ctg tca aga   act aag act gtt ggc   gac gtc atc         3834
Asp Val Asp Ala Leu Ser Arg   Thr Lys Thr Val Gly   Asp Val Ile
    1265                1270                 1275
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110

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gag gcg atg aag ctg gaa ctc  ggt gga ccc caa ggc  cag act ttg        3879
Glu Ala Met Lys Leu Glu Leu  Gly Gly Pro Gln Gly  Gln Thr Leu
    1280            1285                   1290

acc gcg gaa tcg atc cgt cag  cca ccg gtg tct gag  cct gct gta        3924
Thr Ala Glu Ser Ile Arg Gln  Pro Pro Val Ser Glu  Pro Ala Val
    1295            1300                   1305

ccg acc tca tcg tca agc agt  att gct aat gtt tcg  tca gca cgc        3969
Pro Thr Ser Ser Ser Ser Ser  Ile Ala Asn Val Ser  Ser Ala Arg
    1310            1315                   1320

ctc gct gaa gct gaa gcg gcg  gta ctg agc gtt ctc  gca gac aag        4014
Leu Ala Glu Ala Glu Ala Ala  Val Leu Ser Val Leu  Ala Asp Lys
    1325            1330                   1335

aca ggc tac gac agc tca atg  atc gag atg gac atg  gac ctg gag        4059
Thr Gly Tyr Asp Ser Ser Met  Ile Glu Met Asp Met  Asp Leu Glu
    1340            1345                   1350

agc gag ctt ggc gtc gac agc  atc aaa cgc gtg gag  atc atg agc        4104
Ser Glu Leu Gly Val Asp Ser  Ile Lys Arg Val Glu  Ile Met Ser
    1355            1360                   1365

gag gtt caa acg ctg ctc agc  gtg gaa gtc tcc gac  gtt gac gct        4149
Glu Val Gln Thr Leu Leu Ser  Val Glu Val Ser Asp  Val Asp Ala
    1370            1375                   1380

ctg tca aga acc aag act gtt  ggc gac gtc atc gag  gcg atg aag        4194
Leu Ser Arg Thr Lys Thr Val  Gly Asp Val Ile Glu  Ala Met Lys
    1385            1390                   1395

ctg gaa ctc ggt gga ccc caa  ggc cag act ttg acc  gcg gaa tcg        4239
Leu Glu Leu Gly Gly Pro Gln  Gly Gln Thr Leu Thr  Ala Glu Ser
    1400            1405                   1410

atc cgt cag cca ccg gtg tcc  gag cct gct gta ccg  acc tca tcg        4284
Ile Arg Gln Pro Pro Val Ser  Glu Pro Ala Val Pro  Thr Ser Ser
    1415            1420                   1425

tca agc agt att gct aat gtt  ttg tca gca cgc ctc  gct gaa gct        4329
Ser Ser Ser Ile Ala Asn Val  Leu Ser Ala Arg Leu  Ala Glu Ala
    1430            1435                   1440

gaa gcc gcg gta ctg agc gtt  ctc gca gac aag aca  ggc tac gac        4374
Glu Ala Ala Val Leu Ser Val  Leu Ala Asp Lys Thr  Gly Tyr Asp
    1445            1450                   1455

agc tca atg atc gag atg gac  atg gac ctg gag agc  gag ctt ggc        4419
Ser Ser Met Ile Glu Met Asp  Met Asp Leu Glu Ser  Glu Leu Gly
    1460            1465                   1470

gtt gat agc atc aaa cgc gtg  gag atc atg agc gag  gtt caa acg        4464
Val Asp Ser Ile Lys Arg Val  Glu Ile Met Ser Glu  Val Gln Thr
    1475            1480                   1485

ttg ctc agc gtg gaa gtc tcc  gac gtt gac gct ctg  tca aga acc        4509
Leu Leu Ser Val Glu Val Ser  Asp Val Asp Ala Leu  Ser Arg Thr
    1490            1495                   1500

aag act gtt ggc gac gtc atc  gag gcg atg aag ctg  gaa ctc ggt        4554
Lys Thr Val Gly Asp Val Ile  Glu Ala Met Lys Leu  Glu Leu Gly
    1505            1510                   1515

gga ccc caa ggc cag act ttg  acc gcg gaa tcg atc  cgt cag cca        4599
Gly Pro Gln Gly Gln Thr Leu  Thr Ala Glu Ser Ile  Arg Gln Pro
    1520            1525                   1530
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111

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ccg gtg tct gag cct gct gta  ccg acc tca tcg tca  agc agt att          4644
Pro Val Ser Glu Pro Ala Val  Pro Thr Ser Ser Ser  Ser Ser Ile
    1535             1540                  1545

gct aat gtt tcg tca gca cgc  ctc gct gaa gct gaa  gcc gcg gta          4689
Ala Asn Val Ser Ser Ala Arg  Leu Ala Glu Ala Glu  Ala Ala Val
    1550             1555                  1560

ctg agc gtt ctc gca gac aag  aca ggc tac gac agc  tca atg atc          4734
Leu Ser Val Leu Ala Asp Lys  Thr Gly Tyr Asp Ser  Ser Met Ile
    1565             1570                  1575

gag atg gac atg gac ctg gag  agt gag ctt ggc gtc  gac agc atc          4779
Glu Met Asp Met Asp Leu Glu  Ser Glu Leu Gly Val  Asp Ser Ile
    1580             1585                  1590

aaa cgc gtg gag atc atg agc  gag gtt caa acg ctg  ctc agc gtg          4824
Lys Arg Val Glu Ile Met Ser  Glu Val Gln Thr Leu  Leu Ser Val
    1595             1600                  1605

gaa gtc tcc gac gtt gac gct  ctg tca aga acc aag  act gtt ggc          4869
Glu Val Ser Asp Val Asp Ala  Leu Ser Arg Thr Lys  Thr Val Gly
    1610             1615                  1620

gac gtc atc gag gcg atg aag  ctg gaa ctc ggt gga  ccc caa ggc          4914
Asp Val Ile Glu Ala Met Lys  Leu Glu Leu Gly Gly  Pro Gln Gly
    1625             1630                  1635

cag act ttg acc tct gaa ccg  atc cat cag cca cca  gtg tcc gag          4959
Gln Thr Leu Thr Ser Glu Pro  Ile His Gln Pro Pro  Val Ser Glu
    1640             1645                  1650

cct gct gta ccg acc tca tcg  tca agc agt att gct  aat gtt tct          5004
Pro Ala Val Pro Thr Ser Ser  Ser Ser Ser Ile Ala  Asn Val Ser
    1655             1660                  1665

tca gca cgc ctc gct gaa gct  gaa gcc gcg gta ctg  agc gtt ctc          5049
Ser Ala Arg Leu Ala Glu Ala  Glu Ala Ala Val Leu  Ser Val Leu
    1670             1675                  1680

gca gac aag aca ggc tac gac  agc tca atg atc gag  atg gac atg          5094
Ala Asp Lys Thr Gly Tyr Asp  Ser Ser Met Ile Glu  Met Asp Met
    1685             1690                  1695

gac ctg gag agc gag ctt ggc  gtt gat agc atc aaa  cgc gtg gaa          5139
Asp Leu Glu Ser Glu Leu Gly  Val Asp Ser Ile Lys  Arg Val Glu
    1700             1705                  1710

atc atg agc gag gtt caa acg  ctg ctc agc gtg gaa  gtc tcc gac          5184
Ile Met Ser Glu Val Gln Thr  Leu Leu Ser Val Glu  Val Ser Asp
    1715             1720                  1725

gtt gac gct ctg tca aga acc  aag act gtt ggc gac  gtc atc gag          5229
Val Asp Ala Leu Ser Arg Thr  Lys Thr Val Gly Asp  Val Ile Glu
    1730             1735                  1740

gcg atg aag atg gaa ctc ggt  gga ccc caa ggc cag  act ttg acc          5274
Ala Met Lys Met Glu Leu Gly  Gly Pro Gln Gly Gln  Thr Leu Thr
    1745             1750                  1755

gcg gaa tcg atc cgt cag cca  ccg gtg tct gag cct  gct gta ccg          5319
Ala Glu Ser Ile Arg Gln Pro  Pro Val Ser Glu Pro  Ala Val Pro
    1760             1765                  1770

acc tca tcg tca agc agt att  gct aat gtt tcg tca  gca cgc ctc          5364
Thr Ser Ser Ser Ser Ser Ile  Ala Asn Val Ser Ser  Ala Arg Leu
    1775             1780                  1785
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112

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gct gaa gct gaa gcg gcg gta  ctg agc gtt ctc gca  gac aag aca      5409
Ala Glu Ala Glu Ala Ala Val  Leu Ser Val Leu Ala  Asp Lys Thr
    1790             1795              1800

ggc tac gac agc tca atg atc  gag atg gac atg gac  ctg gag agc      5454
Gly Tyr Asp Ser Ser Met Ile  Glu Met Asp Met Asp  Leu Glu Ser
    1805             1810              1815

gag ctt ggc gtt gat agc atc  aaa cgc gtg gag atc  atg agc gag      5499
Glu Leu Gly Val Asp Ser Ile  Lys Arg Val Glu Ile  Met Ser Glu
    1820             1825              1830

gtt caa gcg ctg ctc agc gtg  gaa gtc tcc gac gtt  gac gct ctg      5544
Val Gln Ala Leu Leu Ser Val  Glu Val Ser Asp Val  Asp Ala Leu
    1835             1840              1845

tca aga acc aag act gtt ggc  gac gtc atc gag gcg  atg aag atg      5589
Ser Arg Thr Lys Thr Val Gly  Asp Val Ile Glu Ala  Met Lys Met
    1850             1855              1860

gaa ctc ggt gga ccc caa ggc  cag act ttg acc gca  gaa tcg atc      5634
Glu Leu Gly Gly Pro Gln Gly  Gln Thr Leu Thr Ala  Glu Ser Ile
    1865             1870              1875

cgt gag cca ccg gtg tct gag  cct gct gta ccg acc  tca tcg tca      5679
Arg Glu Pro Pro Val Ser Glu  Pro Ala Val Pro Thr  Ser Ser Ser
    1880             1885              1890

agt agt atc gct aat gtt tct  tca gct cgc ctc gct  gaa gct gaa      5724
Ser Ser Ile Ala Asn Val Ser  Ser Ala Arg Leu Ala  Glu Ala Glu
    1895             1900              1905

gcc gcg gta ctg agc gtt ctc  gca gac aag aca ggc  tac gac agc      5769
Ala Ala Val Leu Ser Val Leu  Ala Asp Lys Thr Gly  Tyr Asp Ser
    1910             1915              1920

tca atg atc gag atg gac atg  gac ctg gag agt gag  ctt ggc gtc      5814
Ser Met Ile Glu Met Asp Met  Asp Leu Glu Ser Glu  Leu Gly Val
    1925             1930              1935

gac agc atc aaa cgc gtg gag  atc atg agc gag gtt  caa acg ttg      5859
Asp Ser Ile Lys Arg Val Glu  Ile Met Ser Glu Val  Gln Thr Leu
    1940             1945              1950

ctc agc gtg gaa gtc tcc gac  gtt gac gct ctg tca  aga acc aag      5904
Leu Ser Val Glu Val Ser Asp  Val Asp Ala Leu Ser  Arg Thr Lys
    1955             1960              1965

act gtt ggc gac gtc atc gag  gcg atg aag ctg gaa  ctt ggg gaa      5949
Thr Val Gly Asp Val Ile Glu  Ala Met Lys Leu Glu  Leu Gly Glu
    1970             1975              1980

tca tca agt att gag act ctc  aat tgt acc gag gtt  gag cac acg      5994
Ser Ser Ser Ile Glu Thr Leu  Asn Cys Thr Glu Val  Glu His Thr
    1985             1990              1995

agc tac aaa agt gtc aag gct  tca ggg tgt gag aat  gta gat acc      6039
Ser Tyr Lys Ser Val Lys Ala  Ser Gly Cys Glu Asn  Val Asp Thr
    2000             2005              2010

cgt ttc gct aag gtt gta caa  atc tcg ctt cct agc  aag ctg aaa      6084
Arg Phe Ala Lys Val Val Gln  Ile Ser Leu Pro Ser  Lys Leu Lys
    2015             2020              2025

tcc act gtg tcg cac gat cga  cct gta att gtt gta  gat gat gga      6129
Ser Thr Val Ser His Asp Arg  Pro Val Ile Val Val  Asp Asp Gly
    2030             2035              2040
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113

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acg ccc tta acc acg gag ctt tgt aaa att ctt ggg ggt aat att          6174
Thr Pro Leu Thr Thr Glu Leu Cys Lys Ile Leu Gly Gly Asn Ile
    2045                2050            2055

gtg gtt ctc tct tat caa ggg aag ccc gct ggt cca cgg gga gtc          6219
Val Val Leu Ser Tyr Gln Gly Lys Pro Ala Gly Pro Arg Gly Val
    2060                2065            2070

gag gtg cca gat ctt tcc gag gaa gcc cta att caa gct ctt gca          6264
Glu Val Pro Asp Leu Ser Glu Glu Ala Leu Ile Gln Ala Leu Ala
    2075                2080            2085

ttg att cgg tct aca tat gga gtt cca att ggt ttt att tgt cag          6309
Leu Ile Arg Ser Thr Tyr Gly Val Pro Ile Gly Phe Ile Cys Gln
    2090                2095            2100

caa gtg tct aat gtg agc acc aag gca cag ctt tgt tgg gca ctc          6354
Gln Val Ser Asn Val Ser Thr Lys Ala Gln Leu Cys Trp Ala Leu
    2105                2110            2115

ctc gca gcg aag cat ctc aag aag gat ttg aat gct gtc tta ccc          6399
Leu Ala Ala Lys His Leu Lys Lys Asp Leu Asn Ala Val Leu Pro
    2120                2125            2130

gat tca aga tcc ttc ttc gtc gga gtt gta cgc ttg aac ggg aaa          6444
Asp Ser Arg Ser Phe Phe Val Gly Val Val Arg Leu Asn Gly Lys
    2135                2140            2145

ctt gga act ttc gaa aac atc agc gac ttc tct aaa ttt gat ttg          6489
Leu Gly Thr Phe Glu Asn Ile Ser Asp Phe Ser Lys Phe Asp Leu
    2150                2155            2160

acg aaa gcc cta gat tac gga cag cgt ggt tct ctc tta ggc ctg          6534
Thr Lys Ala Leu Asp Tyr Gly Gln Arg Gly Ser Leu Leu Gly Leu
    2165                2170            2175

tgc aag tca cta gac tta gaa tgg gaa cag gtg ttt tgc cgt gga          6579
Cys Lys Ser Leu Asp Leu Glu Trp Glu Gln Val Phe Cys Arg Gly
    2180                2185            2190

ata gat ctt gcg tgt gat ctt atg cca ctc cag gcc gca agg ata          6624
Ile Asp Leu Ala Cys Asp Leu Met Pro Leu Gln Ala Ala Arg Ile
    2195                2200            2205

ctc aga aat gag ctt cag tgt ccc aat atg cgc ctt cgc gag gtt          6669
Leu Arg Asn Glu Leu Gln Cys Pro Asn Met Arg Leu Arg Glu Val
    2210                2215            2220

ggg tac gat att tct ggc gcc agg tac acc att tca acc gat gac          6714
Gly Tyr Asp Ile Ser Gly Ala Arg Tyr Thr Ile Ser Thr Asp Asp
    2225                2230            2235

ctg cta tgt gga ccc tcg aag gct aaa gta gag gcc gca gac ttg          6759
Leu Leu Cys Gly Pro Ser Lys Ala Lys Val Glu Ala Ala Asp Leu
    2240                2245            2250

ttt ctt gtg aca ggt ggc gca cga ggt att aca cct cat tgt gtt          6804
Phe Leu Val Thr Gly Gly Ala Arg Gly Ile Thr Pro His Cys Val
    2255                2260            2265

cgt gag att gca agt cga tcc ccc gga acc aca ttt gtg ctg gtt          6849
Arg Glu Ile Ala Ser Arg Ser Pro Gly Thr Thr Phe Val Leu Val
    2270                2275            2280

gga aga agc gaa atg tcc gac gag cct gac tgg gct gtt ggc cac          6894
Gly Arg Ser Glu Met Ser Asp Glu Pro Asp Trp Ala Val Gly His
    2285                2290            2295
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114

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tac aat aaa gac ctg gac caa   agc aca atg aaa cac   ttg aaa gca        6939
Tyr Asn Lys Asp Leu Asp Gln   Ser Thr Met Lys His   Leu Lys Ala
    2300            2305                 2310

acg cat gct gct gga ggg gta   aaa cct acg cct aaa   gca cat cgt        6984
Thr His Ala Ala Gly Gly Val   Lys Pro Thr Pro Lys   Ala His Arg
    2315            2320                 2325

gca ctt gtg aac agg gtc act   ggc tca cgg gag gta   cga gaa tct        7029
Ala Leu Val Asn Arg Val Thr   Gly Ser Arg Glu Val   Arg Glu Ser
    2330            2335                 2340

ctt aga gca atc cag gag gca   ggg gca aat gtc gaa   tat atc gcc        7074
Leu Arg Ala Ile Gln Glu Ala   Gly Ala Asn Val Glu   Tyr Ile Ala
    2345            2350                 2355

tgt gat gtt tcg gat gaa aac   aag gtc cgc caa ctt   gtg caa aga        7119
Cys Asp Val Ser Asp Glu Asn   Lys Val Arg Gln Leu   Val Gln Arg
    2360            2365                 2370

gtg gag caa aag tat ggc tgt   gaa ata act ggg att   tgg cat gca        7164
Val Glu Gln Lys Tyr Gly Cys   Glu Ile Thr Gly Ile   Trp His Ala
    2375            2380                 2385

agc ggg gtt ctt cgt gac aaa   ctt gtc gag caa aag   act aca gac        7209
Ser Gly Val Leu Arg Asp Lys   Leu Val Glu Gln Lys   Thr Thr Asp
    2390            2395                 2400

gac ttt gag gca gtt ttt ggg   acc aag gtg act ggc   ctt gta aac        7254·
Asp Phe Glu Ala Val Phe Gly   Thr Lys Val Thr Gly   Leu Val Asn
    2405            2410                 2415

atc gtg tca caa gtc aat atg   tct aag cta cga cac   ttc atc ctc        7299
Ile Val Ser Gln Val Asn Met   Ser Lys Leu Arg His   Phe Ile Leu
    2420            2425                 2430

ttc agt tct ttg gct gga ttt   cat ggg aac aag ggc   caa acg gat        7344
Phe Ser Ser Leu Ala Gly Phe   His Gly Asn Lys Gly   Gln Thr Asp
    2435            2440                 2445

tat gca att gct aat gaa gcc   ttg aac aaa atc gcg   cat act ctc        7389
Tyr Ala Ile Ala Asn Glu Ala   Leu Asn Lys Ile Ala   His Thr Leu
    2450            2455                 2460

tca gcg ttt ttg ccc aaa ctg   aat gca aag gtg cta   gac ttc ggt        7434
Ser Ala Phe Leu Pro Lys Leu   Asn Ala Lys Val Leu   Asp Phe Gly
    2465            2470                 2475

ccg tgg gta ggt tca gga atg   gta acc gaa aca ctt   gag aag cat        7479
Pro Trp Val Gly Ser Gly Met   Val Thr Glu Thr Leu   Glu Lys His
    2480            2485                 2490

ttt aaa gct atg ggg gtt cag   act att cct ctc gag   cca gga gca        7524
Phe Lys Ala Met Gly Val Gln   Thr Ile Pro Leu Glu   Pro Gly Ala
    2495            2500                 2505

cgg act gtt gcg caa atc att   ttg gca agt tcg cca   ccg caa tcg        7569
Arg Thr Val Ala Gln Ile Ile   Leu Ala Ser Ser Pro   Pro Gln Ser
    2510            2515                 2520

ctt ttg ggg aac tgg ggc ttt   cca gcc acc aaa ccg   cta caa cgc        7614
Leu Leu Gly Asn Trp Gly Phe   Pro Ala Thr Lys Pro   Leu Gln Arg
    2525            2530                 2535

tct aat gta gtc acg ggc aca   ctc tct ccg gaa gag   ata gaa ttc        7659
Ser Asn Val Val Thr Gly Thr   Leu Ser Pro Glu Glu   Ile Glu Phe
    2540            2545                 2550
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115

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atc gca gac cac aaa att caa  ggc cgc aag gtg ctt  ccc atg atg      7704
Ile Ala Asp His Lys Ile Gln  Gly Arg Lys Val Leu  Pro Met Met
    2555             2560               2565

gct gca atc ggg ttc atg gcc  tct att gcg gaa gga  ctc tac ccg      7749
Ala Ala Ile Gly Phe Met Ala  Ser Ile Ala Glu Gly  Leu Tyr Pro
    2570             2575               2580

ggg tac aat ctg caa ggc gtg  gaa aat gct cag ctc  ttt caa ggc      7794
Gly Tyr Asn Leu Gln Gly Val  Glu Asn Ala Gln Leu  Phe Gln Gly
    2585             2590               2595

ttg act atc aac caa gag aca  aaa ttt caa atc act  ctc att gag      7839
Leu Thr Ile Asn Gln Glu Thr  Lys Phe Gln Ile Thr  Leu Ile Glu
    2600             2605               2610

gag cac aac tct gag gaa aac  ctg gat gtc ctg aca  tcc ctt ggt      7884
Glu His Asn Ser Glu Glu Asn  Leu Asp Val Leu Thr  Ser Leu Gly
    2615             2620               2625

gta atg ttg gaa agc ggg aag  gtg ctt ccc gct tac  cga tgt gtt      7929
Val Met Leu Glu Ser Gly Lys  Val Leu Pro Ala Tyr  Arg Cys Val
    2630             2635               2640

gta tgc ttg aat aca acc cag  cag cag ccc aag cta  tct cca aaa      7974
Val Cys Leu Asn Thr Thr Gln  Gln Gln Pro Lys Leu  Ser Pro Lys
    2645             2650               2655

att ctt aac ttg gaa gtt gac  cct gca tgc gag gtt  aac ccc tat      8019
Ile Leu Asn Leu Glu Val Asp  Pro Ala Cys Glu Val  Asn Pro Tyr
    2660             2665               2670

gat gga aag tcg ttg ttc cac  ggt ccg ctt ttg caa  ttc gtt caa      8064
Asp Gly Lys Ser Leu Phe His  Gly Pro Leu Leu Gln  Phe Val Gln
    2675             2680               2685

caa gtg ttg cac tca agt acc  aaa ggc ctc gtt gcc  aag tgc cgc      8109
Gln Val Leu His Ser Ser Thr  Lys Gly Leu Val Ala  Lys Cys Arg
    2690             2695               2700

gcg ctt cca atc aaa gaa gcc  atc cga ggg cca ttt  atc aag caa      8154
Ala Leu Pro Ile Lys Glu Ala  Ile Arg Gly Pro Phe  Ile Lys Gln
    2705             2710               2715

aca ctc cat gat cca att cta  gac gac gtc att ttt  cag cta atg      8199
Thr Leu His Asp Pro Ile Leu  Asp Asp Val Ile Phe  Gln Leu Met
    2720             2725               2730

ctc gtg tgg tgt cgt aat gct  cta gga agt gca tcg  cta ccc aac      8244
Leu Val Trp Cys Arg Asn Ala  Leu Gly Ser Ala Ser  Leu Pro Asn
    2735             2740               2745

aga att gaa aag atg tca tac  ttt ggg aat gtc tca  gaa ggt agc      8289
Arg Ile Glu Lys Met Ser Tyr  Phe Gly Asn Val Ser  Glu Gly Ser
    2750             2755               2760

act ttc ttt gcc tca gtt aca  cct gtg gga cca aga  gta cca aag      8334
Thr Phe Phe Ala Ser Val Thr  Pro Val Gly Pro Arg  Val Pro Lys
    2765             2770               2775

gat ccc gtg atc aaa atg cag  ttt ctt ctc caa gat  gaa tcc ggc      8379
Asp Pro Val Ile Lys Met Gln  Phe Leu Leu Gln Asp  Glu Ser Gly
    2780             2785               2790

aac aca ttt tca tcg ggg gag  ggc tcg gtt gtg ctt  agt gac gaa      8424
Asn Thr Phe Ser Ser Gly Glu  Gly Ser Val Val Leu  Ser Asp Glu
    2795             2800               2805
```

116

```
ctc gtc  ttt tga                                                    8436
Leu Val  Phe
    2810


<210>  39
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<400>  39

Met Lys Asp Met Glu Asp Arg Arg Val Ala Ile Val Gly Met Ser Ala
1               5                   10                  15


His Leu Pro Cys Gly Thr Asp Val Lys Glu Ser Trp Gln Ala Ile Arg
            20                  25                  30


Asp Gly Ile Asp Cys Leu Ser Asp Leu Pro Ala Asp Arg Leu Asp Val
        35                  40                  45


Thr Ala Tyr Tyr Asn Pro Asn Lys Ala Thr Lys Asp Lys Ile Tyr Cys
    50                  55                  60


Lys Arg Gly Gly Phe Ile Pro Asn Tyr Asp Phe Asp Pro Arg Glu Phe
65                  70                  75                  80


Gly Leu Asn Met Phe Gln Met Glu Asp Ser Asp Ala Asn Gln Thr Leu
                85                  90                  95


Thr Leu Leu Lys Val Lys Gln Ala Leu Glu Asp Ala Ser Ile Glu Pro
            100                 105                 110


Phe Thr Lys Glu Lys Lys Asn Ile Gly Cys Val Leu Gly Ile Gly Gly
        115                 120                 125


Gly Gln Lys Ala Ser His Glu Phe Tyr Ser Arg Leu Asn Tyr Val Val
    130                 135                 140


Val Glu Lys Val Leu Arg Lys Met Gly Leu Pro Asp Ala Asp Val Glu
145                 150                 155                 160


Glu Ala Val Glu Lys Tyr Lys Ala Asn Phe Pro Glu Trp Arg Leu Asp
                165                 170                 175


Ser Phe Pro Gly Phe Leu Gly Asn Val Thr Ala Gly Arg Cys Ser Asn
            180                 185                 190


Thr Phe Asn Met Glu Gly Met Asn Cys Val Val Asp Ala Ala Cys Ala
            195                 200                 205


Ser Ser Leu Ile Ala Ile Lys Val Ala Val Glu Glu Leu Leu Phe Gly
    210                 215                 220


                                117
```

```
Asp Cys Asp Thr Met Ile Ala Gly Ala Thr Cys Thr Asp Asn Ser Leu
225                 230             235             240


Gly Met Tyr Met Ala Phe Ser Lys Thr Pro Val Phe Ser Thr Asp Pro
                245             250             255


Ser Val Arg Ala Tyr Asp Glu Lys Thr Lys Gly Met Leu Ile Gly Glu
            260             265             270


Gly Ser Ala Met Phe Val Leu Lys Arg Tyr Ala Asp Ala Val Arg Asp
            275             280             285


Gly Asp Thr Ile His Ala Val Leu Arg Ser Cys Ser Ser Ser Ser Asp
        290             295             300


Gly Lys Ala Ala Gly Ile Tyr Thr Pro Thr Ile Ser Gly Gln Glu Glu
305             310             315             320


Ala Leu Arg Arg Ala Tyr Ala Arg Ala Gly Val Cys Pro Ser Thr Ile
            325             330             335


Gly Leu Val Glu Gly His Gly Thr Gly Thr Pro Val Gly Asp Arg Ile
            340             345             350


Glu Leu Thr Ala Leu Arg Asn Leu Phe Asp Lys Ala Phe Gly Ser Lys
            355             360             365


Lys Glu Gln Ile Ala Val Gly Ser Ile Lys Ser Gln Ile Gly His Leu
        370             375             380


Lys Ser Val Ala Gly Phe Ala Gly Leu Val Lys Ala Val Leu Ala Leu
385             390             395             400


Lys His Lys Thr Leu Pro Gly Ser Ile Asn Val Asp Gln Pro Pro Leu
            405             410             415


Leu Tyr Asp Gly Thr Gln Ile Gln Asp Ser Ser Leu Tyr Ile Asn Lys
            420             425             430


Thr Asn Arg Pro Trp Phe Thr Gln Asn Lys Leu Pro Arg Arg Ala Gly
        435             440             445


Val Ser Ser Phe Gly Phe Gly Gly Ala Asn Tyr His Ala Val Leu Glu
    450             455             460


Glu Phe Glu Pro Glu His Glu Lys Pro Tyr Arg Leu Asn Thr Val Gly
465             470             475             480


His Pro Val Leu Leu Tyr Ala Pro Ser Val Glu Ala Leu Lys Val Leu
            485             490             495
```

118

```
Cys Asn Asp Gln Leu Ala Glu Leu Thr Ile Ala Leu Glu Glu Ala Lys
        500                 505             510

Thr His Lys Asn Val Asp Lys Val Cys Gly Tyr Lys Phe Ile Asp Glu
        515             520             525

Phe Gln Leu Gln Gly Ser Cys Pro Pro Glu Asn Pro Arg Val Gly Phe
    530             535             540

Leu Ala Thr Leu Pro Thr Ser Asn Ile Ile Val Ala Leu Lys Ala Ile
545             550             555             560

Leu Ala Gln Leu Asp Ala Lys Pro Asp Ala Lys Lys Trp Asp Leu Pro
            565             570             575

His Lys Lys Ala Phe Gly Ala Thr Phe Ala Ser Ser Ser Val Lys Gly
            580             585             590

Ser Val Ala Ala Leu Phe Ala Gly Gln Gly Thr Gln Tyr Leu Asn Met
            595             600             605

Phe Ser Asp Val Ala Met Asn Trp Pro Pro Phe Arg Asp Ser Ile Val
    610             615             620

Ala Met Glu Glu Ala Gln Thr Glu Val Phe Glu Gly Gln Val Glu Pro
625             630             635             640

Ile Ser Lys Val Leu Phe Pro Arg Glu Arg Tyr Ala Ser Glu Ser Glu
            645             650             655

Gln Gly Asn Glu Leu Leu Cys Leu Thr Glu Tyr Ser Gln Pro Thr Thr
            660             665             670

Ile Ala Ala Ala Val Gly Ala Phe Asp Ile Phe Lys Ala Ala Gly Phe
            675             680             685

Lys Pro Asp Met Val Gly Gly His Ser Leu Gly Glu Phe Ala Ala Leu
    690             695             700

Tyr Ala Ala Gly Ser Ile Ser Arg Asp Asp Leu Tyr Lys Leu Val Cys
705             710             715             720

Lys Arg Ala Lys Ala Met Ala Asn Ala Ser Asp Gly Ala Met Ala Ala
            725             730             735

Val Ile Gly Pro Asp Ala Arg Leu Val Thr Pro Gln Asn Ser Asp Val
            740             745             750

Tyr Val Ala Asn Phe Asn Ser Ala Thr Gln Val Val Ile Ser Gly Thr
            755             760             765
```

119

Val Gln Gly Val Lys Glu Glu Ser Lys Leu Leu Ile Ser Lys Gly Phe
    770   775   780

Arg Val Leu Pro Leu Lys Cys Gln Gly Ala Phe His Ser Pro Leu Met
785   790   795   800

Gly Pro Ser Glu Asp Ser Phe Lys Ser Leu Val Glu Thr Cys Thr Ile
            805   810   815

Ser Pro Pro Lys Asn Val Lys Phe Phe Cys Asn Val Ser Gly Lys Glu
            820   825   830

Ser Pro Asn Pro Lys Gln Thr Leu Lys Ser His Met Thr Ser Ser Val
            835   840   845

Gln Phe Glu Glu Gln Ile Arg Asn Met Tyr Asp Ala Gly Ala Arg Val
    850   855   860

Phe Leu Glu Phe Gly Pro Arg Gln Val Leu Ala Lys Leu Ile Ala Glu
865   870   875   880

Met Phe Pro Ser Cys Thr Ala Ile Ser Val Asn Pro Ala Ser Ser Gly
            885   890   895

Asp Ser Asp Val Gln Leu Arg Leu Ala Ala Val Lys Phe Ala Val Ser
            900   905   910

Gly Ala Ala Leu Ser Thr Phe Asp Pro Trp Glu Tyr Arg Lys Pro Gln
            915   920   925

Asp Leu Leu Ile Arg Lys Pro Arg Lys Thr Ala Leu Val Leu Ser Ala
    930   935   940

Ala Thr Tyr Val Ser Pro Lys Thr Leu Ala Glu Arg Lys Lys Ala Met
945   950   955   960

Glu Asp Ile Lys Leu Val Ser Ile Thr Pro Arg Asp Ser Met Val Ser
            965   970   975

Ile Gly Lys Ile Ala Gln Glu Val Arg Thr Ala Lys Gln Pro Leu Glu
            980   985   990

Thr Glu Ile Arg Arg Leu Asn Lys Glu Leu Glu His Leu Lys Arg Glu
    995   1000   1005

Leu Ala Ala Ala Lys Ala Ser Val Lys Ser Ala Ser Lys Ser Ser
    1010   1015   1020

Lys Glu Arg Ser Val Leu Ser Lys His Arg Ala Leu Leu Gln Asn
    1025   1030   1035

120

```
Ile Leu  Gln Asp Tyr Asp Asp  Leu Arg Val Val Pro  Phe Ala Val
    1040                 1045             1050
```

```
Arg Ser  Val Ala Val Asp Asn  Thr Ala Pro Tyr Ala  Asp Gln Val
    1055                 1060             1065
```

```
Ser Thr  Pro Ala Ser Glu Arg  Ser Ala Ser Pro Leu  Phe Glu Lys
    1070                 1075             1080
```

```
Arg Ser  Ser Val Ser Ser Ala  Arg Leu Ala Glu Ala  Glu Ala Ala
    1085                 1090             1095
```

```
Val Leu  Ser Val Leu Ala Asp  Lys Thr Gly Tyr Asp  Ser Ser Met
    1100                 1105             1110
```

```
Ile Glu  Met Asp Met Asp Leu  Glu Ser Glu Leu Gly  Val Asp Ser
    1115                 1120             1125
```

```
Ile Lys  Arg Val Glu Ile Met  Ser Glu Val Gln Thr  Leu Leu Ser
    1130                 1135             1140
```

```
Val Glu  Val Ser Asp Val Asp  Ala Leu Ser Arg Thr  Lys Thr Val
    1145                 1150             1155
```

```
Gly Asp  Val Ile Glu Ala Met  Lys Leu Glu Leu Gly  Gly Pro Gln
    1160                 1165             1170
```

```
Gly Gln  Thr Leu Thr Ala Glu  Ser Ile Arg Gln Pro  Pro Val Ser
    1175                 1180             1185
```

```
Glu Pro  Ala Val Pro Thr Ser  Ser Ser Ser Ser Ile  Ala Asn Val
    1190                 1195             1200
```

```
Ser Ser  Ala Arg Leu Ala Glu  Ala Glu Ala Ala Val  Leu Ser Val
    1205                 1210             1215
```

```
Leu Ala  Asp Lys Thr Gly Tyr  Asp Ser Ser Met Ile  Glu Met Asp
    1220                 1225             1230
```

```
Met Asp  Leu Glu Ser Glu Leu  Gly Val Asp Ser Ile  Lys Arg Val
    1235                 1240             1245
```

```
Glu Ile  Met Ser Glu Val Gln  Thr Leu Leu Ser Val  Glu Val Ser
    1250                 1255             1260
```

```
Asp Val  Asp Ala Leu Ser Arg  Thr Lys Thr Val Gly  Asp Val Ile
    1265                 1270             1275
```

```
Glu Ala  Met Lys Leu Glu Leu  Gly Gly Pro Gln Gly  Gln Thr Leu
    1280                 1285             1290
```

```
Thr Ala  Glu Ser Ile Arg Gln  Pro Pro Val Ser Glu  Pro Ala Val
    1295             1300             1305

Pro Thr  Ser Ser Ser Ser Ser  Ile Ala Asn Val Ser  Ser Ala Arg
    1310             1315             1320

Leu Ala  Glu Ala Glu Ala Ala  Val Leu Ser Val Leu  Ala Asp Lys
    1325             1330             1335

Thr Gly  Tyr Asp Ser Ser Met  Ile Glu Met Asp Met  Asp Leu Glu
    1340             1345             1350

Ser Glu  Leu Gly Val Asp Ser  Ile Lys Arg Val Glu  Ile Met Ser
    1355             1360             1365

Glu Val  Gln Thr Leu Leu Ser  Val Glu Val Ser Asp  Val Asp Ala
    1370             1375             1380

Leu Ser  Arg Thr Lys Thr Val  Gly Asp Val Ile Glu  Ala Met Lys
    1385             1390             1395

Leu Glu  Leu Gly Gly Pro Gln  Gly Gln Thr Leu Thr  Ala Glu Ser
    1400             1405             1410

Ile Arg  Gln Pro Pro Val Ser  Glu Pro Ala Val Pro  Thr Ser Ser
    1415             1420             1425

Ser Ser  Ser Ile Ala Asn Val  Leu Ser Ala Arg Leu  Ala Glu Ala
    1430             1435             1440

Glu Ala  Ala Val Leu Ser Val  Leu Ala Asp Lys Thr  Gly Tyr Asp
    1445             1450             1455

Ser Ser  Met Ile Glu Met Asp  Met Asp Leu Glu Ser  Glu Leu Gly
    1460             1465             1470

Val Asp  Ser Ile Lys Arg Val  Glu Ile Met Ser Glu  Val Gln Thr
    1475             1480             1485

Leu Leu  Ser Val Glu Val Ser  Asp Val Asp Ala Leu  Ser Arg Thr
    1490             1495             1500

Lys Thr  Val Gly Asp Val Ile  Glu Ala Met Lys Leu  Glu Leu Gly
    1505             1510             1515

Gly Pro  Gln Gly Gln Thr Leu  Thr Ala Glu Ser Ile  Arg Gln Pro
    1520             1525             1530

Pro Val  Ser Glu Pro Ala Val  Pro Thr Ser Ser Ser  Ser Ser Ile
    1535             1540             1545
```

122

```
Ala Asn  Val Ser Ser Ala Arg  Leu Ala Glu Ala Glu  Ala Ala Val
    1550             1555             1560

Leu Ser  Val Leu Ala Asp Lys  Thr Gly Tyr Asp Ser  Ser Met Ile
    1565             1570             1575

Glu Met  Asp Met Asp Leu Glu  Ser Glu Leu Gly Val  Asp Ser Ile
    1580             1585             1590

Lys Arg  Val Glu Ile Met Ser  Glu Val Gln Thr Leu  Leu Ser Val
    1595             1600             1605

Glu Val  Ser Asp Val Asp Ala  Leu Ser Arg Thr Lys  Thr Val Gly
    1610             1615             1620

Asp Val  Ile Glu Ala Met Lys  Leu Glu Leu Gly Gly  Pro Gln Gly
    1625             1630             1635

Gln Thr  Leu Thr Ser Glu Pro  Ile His Gln Pro Pro  Val Ser Glu
    1640             1645             1650

Pro Ala  Val Pro Thr Ser Ser  Ser Ser Ser Ile Ala  Asn Val Ser
    1655             1660             1665

Ser Ala  Arg Leu Ala Glu Ala  Glu Ala Ala Val Leu  Ser Val Leu
    1670             1675             1680

Ala Asp  Lys Thr Gly Tyr Asp  Ser Ser Met Ile Glu  Met Asp Met
    1685             1690             1695

Asp Leu  Glu Ser Glu Leu Gly  Val Asp Ser Ile Lys  Arg Val Glu
    1700             1705             1710

Ile Met  Ser Glu Val Gln Thr  Leu Leu Ser Val Glu  Val Ser Asp
    1715             1720             1725

Val Asp  Ala Leu Ser Arg Thr  Lys Thr Val Gly Asp  Val Ile Glu
    1730             1735             1740

Ala Met  Lys Met Glu Leu Gly  Gly Pro Gln Gly Gln  Thr Leu Thr
    1745             1750             1755

Ala Glu  Ser Ile Arg Gln Pro  Pro Val Ser Glu Pro  Ala Val Pro
    1760             1765             1770

Thr Ser  Ser Ser Ser Ser Ile  Ala Asn Val Ser Ser  Ala Arg Leu
    1775             1780             1785

Ala Glu  Ala Glu Ala Ala Val  Leu Ser Val Leu Ala  Asp Lys Thr
    1790             1795             1800
```

123

```
Gly Tyr  Asp Ser Ser Met Ile  Glu Met Asp Met Asp  Leu Glu Ser
    1805                 1810              1815

Glu Leu  Gly Val Asp Ser Ile  Lys Arg Val Glu Ile  Met Ser Glu
    1820                 1825              1830

Val Gln  Ala Leu Leu Ser Val  Glu Val Ser Asp Val  Asp Ala Leu
    1835                 1840              1845

Ser Arg  Thr Lys Thr Val Gly  Asp Val Ile Glu Ala  Met Lys Met
    1850                 1855              1860

Glu Leu  Gly Gly Pro Gln Gly  Gln Thr Leu Thr Ala  Glu Ser Ile
    1865                 1870              1875

Arg Glu  Pro Pro Val Ser Glu  Pro Ala Val Pro Thr  Ser Ser Ser
    1880                 1885              1890

Ser Ser  Ile Ala Asn Val Ser  Ser Ala Arg Leu Ala  Glu Ala Glu
    1895                 1900              1905

Ala Ala  Val Leu Ser Val Leu  Ala Asp Lys Thr Gly  Tyr Asp Ser
    1910                 1915              1920

Ser Met  Ile Glu Met Asp Met  Asp Leu Glu Ser Glu  Leu Gly Val
    1925                 1930              1935

Asp Ser  Ile Lys Arg Val Glu  Ile Met Ser Glu Val  Gln Thr Leu
    1940                 1945              1950

Leu Ser  Val Glu Val Ser Asp  Val Asp Ala Leu Ser  Arg Thr Lys
    1955                 1960              1965

Thr Val  Gly Asp Val Ile Glu  Ala Met Lys Leu Glu  Leu Gly Glu
    1970                 1975              1980

Ser Ser  Ser Ile Glu Thr Leu  Asn Cys Thr Glu Val  Glu His Thr
    1985                 1990              1995

Ser Tyr  Lys Ser Val Lys Ala  Ser Gly Cys Glu Asn  Val Asp Thr
    2000                 2005              2010

Arg Phe  Ala Lys Val Val Gln  Ile Ser Leu Pro Ser  Lys Leu Lys
    2015                 2020              2025

Ser Thr  Val Ser His Asp Arg  Pro Val Ile Val Val  Asp Asp Gly
    2030                 2035              2040

Thr Pro  Leu Thr Thr Glu Leu  Cys Lys Ile Leu Gly  Gly Asn Ile
    2045                 2050              2055
```

124

```
Val Val  Leu Ser Tyr Gln Gly  Lys Pro Ala Gly Pro  Arg Gly Val
    2060             2065             2070

Glu Val  Pro Asp Leu Ser Glu  Glu Ala Leu Ile Gln  Ala Leu Ala
    2075             2080             2085

Leu Ile  Arg Ser Thr Tyr Gly  Val Pro Ile Gly Phe  Ile Cys Gln
    2090             2095             2100

Gln Val  Ser Asn Val Ser Thr  Lys Ala Gln Leu Cys  Trp Ala Leu
    2105             2110             2115

Leu Ala  Ala Lys His Leu Lys  Lys Asp Leu Asn Ala  Val Leu Pro
    2120             2125             2130

Asp Ser  Arg Ser Phe Phe Val  Gly Val Val Arg Leu  Asn Gly Lys
    2135             2140             2145

Leu Gly  Thr Phe Glu Asn Ile  Ser Asp Phe Ser Lys  Phe Asp Leu
    2150             2155             2160

Thr Lys  Ala Leu Asp Tyr Gly  Gln Arg Gly Ser Leu  Leu Gly Leu
    2165             2170             2175

Cys Lys  Ser Leu Asp Leu Glu  Trp Glu Gln Val Phe  Cys Arg Gly
    2180             2185             2190

Ile Asp  Leu Ala Cys Asp Leu  Met Pro Leu Gln Ala  Ala Arg Ile
    2195             2200             2205

Leu Arg  Asn Glu Leu Gln Cys  Pro Asn Met Arg Leu  Arg Glu Val
    2210             2215             2220

Gly Tyr  Asp Ile Ser Gly Ala  Arg Tyr Thr Ile Ser  Thr Asp Asp
    2225             2230             2235

Leu Leu  Cys Gly Pro Ser Lys  Ala Lys Val Glu Ala  Ala Asp Leu
    2240             2245             2250

Phe Leu  Val Thr Gly Gly Ala  Arg Gly Ile Thr Pro  His Cys Val
    2255             2260             2265

Arg Glu  Ile Ala Ser Arg Ser  Pro Gly Thr Thr Phe  Val Leu Val
    2270             2275             2280

Gly Arg  Ser Glu Met Ser Asp  Glu Pro Asp Trp Ala  Val Gly His
    2285             2290             2295

Tyr Asn  Lys Asp Leu Asp Gln  Ser Thr Met Lys His  Leu Lys Ala
    2300             2305             2310
```

125

```
Thr His  Ala Ala Gly Gly Val  Lys Pro Thr Pro Lys  Ala His Arg
    2315              2320              2325

Ala Leu  Val Asn Arg Val Thr  Gly Ser Arg Glu Val  Arg Glu Ser
    2330              2335              2340

Leu Arg  Ala Ile Gln Glu Ala  Gly Ala Asn Val Glu  Tyr Ile Ala
    2345              2350              2355

Cys Asp  Val Ser Asp Glu Asn  Lys Val Arg Gln Leu  Val Gln Arg
    2360              2365              2370

Val Glu  Gln Lys Tyr Gly Cys  Glu Ile Thr Gly Ile  Trp His Ala
    2375              2380              2385

Ser Gly  Val Leu Arg Asp Lys  Leu Val Glu Gln Lys  Thr Thr Asp
    2390              2395              2400

Asp Phe  Glu Ala Val Phe Gly  Thr Lys Val Thr Gly  Leu Val Asn
    2405              2410              2415

Ile Val  Ser Gln Val Asn Met  Ser Lys Leu Arg His  Phe Ile Leu
    2420              2425              2430

Phe Ser  Ser Leu Ala Gly Phe  His Gly Asn Lys Gly  Gln Thr Asp
    2435              2440              2445

Tyr Ala  Ile Ala Asn Glu Ala  Leu Asn Lys Ile Ala  His Thr Leu
    2450              2455              2460

Ser Ala  Phe Leu Pro Lys Leu  Asn Ala Lys Val Leu  Asp Phe Gly
    2465              2470              2475

Pro Trp  Val Gly Ser Gly Met  Val Thr Glu Thr Leu  Glu Lys His
    2480              2485              2490

Phe Lys  Ala Met Gly Val Gln  Thr Ile Pro Leu Glu  Pro Gly Ala
    2495              2500              2505

Arg Thr  Val Ala Gln Ile Ile  Leu Ala Ser Ser Pro  Pro Gln Ser
    2510              2515              2520

Leu Leu  Gly Asn Trp Gly Phe  Pro Ala Thr Lys Pro  Leu Gln Arg
    2525              2530              2535

Ser Asn  Val Val Thr Gly Thr  Leu Ser Pro Glu Glu  Ile Glu Phe
    2540              2545              2550

Ile Ala  Asp His Lys Ile Gln  Gly Arg Lys Val Leu  Pro Met Met
    2555              2560              2565
```

126

Ala Ala Ile Gly Phe Met Ala Ser Ile Ala Glu Gly Leu Tyr Pro
    2570   2575   2580

Gly Tyr Asn Leu Gln Gly Val Glu Asn Ala Gln Leu Phe Gln Gly
    2585   2590   2595

Leu Thr Ile Asn Gln Glu Thr Lys Phe Gln Ile Thr Leu Ile Glu
    2600   2605   2610

Glu His Asn Ser Glu Glu Asn Leu Asp Val Leu Thr Ser Leu Gly
    2615   2620   2625

Val Met Leu Glu Ser Gly Lys Val Leu Pro Ala Tyr Arg Cys Val
    2630   2635   2640

Val Cys Leu Asn Thr Thr Gln Gln Gln Pro Lys Leu Ser Pro Lys
    2645   2650   2655

Ile Leu Asn Leu Glu Val Asp Pro Ala Cys Glu Val Asn Pro Tyr
    2660   2665   2670

Asp Gly Lys Ser Leu Phe His Gly Pro Leu Leu Gln Phe Val Gln
    2675   2680   2685

Gln Val Leu His Ser Ser Thr Lys Gly Leu Val Ala Lys Cys Arg
    2690   2695   2700

Ala Leu Pro Ile Lys Glu Ala Ile Arg Gly Pro Phe Ile Lys Gln
    2705   2710   2715

Thr Leu His Asp Pro Ile Leu Asp Asp Val Ile Phe Gln Leu Met
    2720   2725   2730

Leu Val Trp Cys Arg Asn Ala Leu Gly Ser Ala Ser Leu Pro Asn
    2735   2740   2745

Arg Ile Glu Lys Met Ser Tyr Phe Gly Asn Val Ser Glu Gly Ser
    2750   2755   2760

Thr Phe Phe Ala Ser Val Thr Pro Val Gly Pro Arg Val Pro Lys
    2765   2770   2775

Asp Pro Val Ile Lys Met Gln Phe Leu Leu Gln Asp Glu Ser Gly
    2780   2785   2790

Asn Thr Phe Ser Ser Gly Glu Gly Ser Val Val Leu Ser Asp Glu
    2795   2800   2805

Leu Val Phe
    2810

127

<210> 40
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<400> 40
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atg aag gac atg gaa gat aga cgg gtc gct att gtg ggc atg tca gct        48
Met Lys Asp Met Glu Asp Arg Arg Val Ala Ile Val Gly Met Ser Ala
1               5                   10                  15

cac ttg cct tgt ggg aca gat gtg aag gaa tca tgg cag gct att cgc        96
His Leu Pro Cys Gly Thr Asp Val Lys Glu Ser Trp Gln Ala Ile Arg
                20                  25                  30

gat gga atc gac tgt cta agt gac cta ccc gcg gat cgt ctc gac gtt       144
Asp Gly Ile Asp Cys Leu Ser Asp Leu Pro Ala Asp Arg Leu Asp Val
            35                  40                  45

aca gct tac tac aat ccc aac aaa gcc acg aaa gac aag atc tac tgc       192
Thr Ala Tyr Tyr Asn Pro Asn Lys Ala Thr Lys Asp Lys Ile Tyr Cys
        50                  55                  60

aaa cgg ggt ggc ttc atc ccg aac tat gac ttc gac ccc cgc gaa ttt       240
Lys Arg Gly Gly Phe Ile Pro Asn Tyr Asp Phe Asp Pro Arg Glu Phe
65                  70                  75                  80

ggg ctc aac atg ttt caa atg gaa gac tct gat gcg aat cag aca ctt       288
Gly Leu Asn Met Phe Gln Met Glu Asp Ser Asp Ala Asn Gln Thr Leu
                85                  90                  95

acc ttg ctc aaa gtc aaa caa gct ctc gaa gat gca agc ata gag cct       336
Thr Leu Leu Lys Val Lys Gln Ala Leu Glu Asp Ala Ser Ile Glu Pro
                100                 105                 110

ttc acc aag gag aag aag aac att gga tgt gtt tta ggt att ggt ggg       384
Phe Thr Lys Glu Lys Lys Asn Ile Gly Cys Val Leu Gly Ile Gly Gly
            115                 120                 125

ggc caa aag gcg agt cat gag ttc tac tct cgt ctc aac tac gtt gtc       432
Gly Gln Lys Ala Ser His Glu Phe Tyr Ser Arg Leu Asn Tyr Val Val
        130                 135                 140

gtt gaa aag gta ctt cgg aaa atg ggt tta cca gat gct gat gtt gaa       480
Val Glu Lys Val Leu Arg Lys Met Gly Leu Pro Asp Ala Asp Val Glu
145                 150                 155                 160

gaa gct gtg gag aaa tac aag gca aat ttt ccc gag tgg cgc cta gac       528
Glu Ala Val Glu Lys Tyr Lys Ala Asn Phe Pro Glu Trp Arg Leu Asp
                165                 170                 175

tct ttc cct ggg ttt ctt ggg aat gta acg gct ggt cgg tgc agt aac       576
Ser Phe Pro Gly Phe Leu Gly Asn Val Thr Ala Gly Arg Cys Ser Asn
                180                 185                 190

acc ttc aac atg gaa ggt atg aac tgc gtt gtg gat gct gca tgt gcc       624
Thr Phe Asn Met Glu Gly Met Asn Cys Val Val Asp Ala Ala Cys Ala
            195                 200                 205

agt tct cta att gca atc aag gtt gca gtt gaa gag cta ctc ttt ggt       672
Ser Ser Leu Ile Ala Ile Lys Val Ala Val Glu Glu Leu Leu Phe Gly
        210                 215                 220

gac tgt gac acc atg att gca ggt gcc acc tgc acg gac aat tca ctt       720
```

```
Asp Cys Asp Thr Met Ile Ala Gly Ala Thr Cys Thr Asp Asn Ser Leu
225                 230                 235                 240

ggc atg tac atg gcc ttc tct aaa acg cca gtt ttt tct act gac cca     768
Gly Met Tyr Met Ala Phe Ser Lys Thr Pro Val Phe Ser Thr Asp Pro
                245                 250                 255

agt gtc cgc gcg tat gat gag aaa aca aaa ggg atg cta att gga gaa     816
Ser Val Arg Ala Tyr Asp Glu Lys Thr Lys Gly Met Leu Ile Gly Glu
                260                 265                 270

ggt tca gca atg ttc gtt ctt aaa cgc tat gcg gat gcc gta cgt gat     864
Gly Ser Ala Met Phe Val Leu Lys Arg Tyr Ala Asp Ala Val Arg Asp
            275                 280                 285

ggc gac aca att cac gcg gtt ctg cgt tct tgc tct tcg tct agt gat     912
Gly Asp Thr Ile His Ala Val Leu Arg Ser Cys Ser Ser Ser Ser Asp
        290                 295                 300

gga aaa gcg gca gga att tat act cct act ata tct gga caa gaa gaa     960
Gly Lys Ala Ala Gly Ile Tyr Thr Pro Thr Ile Ser Gly Gln Glu Glu
305                 310                 315                 320

gct ttg cgt cga gcg tat gcc cgt gcg ggg gta tgt cca tct acg atc    1008
Ala Leu Arg Arg Ala Tyr Ala Arg Ala Gly Val Cys Pro Ser Thr Ile
                325                 330                 335

ggg ctt gtt gag ggt cac ggg aca ggg acc cct gtt gga gat cgc att    1056
Gly Leu Val Glu Gly His Gly Thr Gly Thr Pro Val Gly Asp Arg Ile
                340                 345                 350

gag tta aca gct ctg cgg aac ttg ttt gac aaa gct ttt ggt agc aag    1104
Glu Leu Thr Ala Leu Arg Asn Leu Phe Asp Lys Ala Phe Gly Ser Lys
            355                 360                 365

aag gaa caa ata gca gtt ggc agc ata aag tct cag ata ggt cac ctg    1152
Lys Glu Gln Ile Ala Val Gly Ser Ile Lys Ser Gln Ile Gly His Leu
        370                 375                 380

aaa tct gtt gcc ggc ttt gcc ggc ttg gtc aaa gct gtg ctt gcg ctt    1200
Lys Ser Val Ala Gly Phe Ala Gly Leu Val Lys Ala Val Leu Ala Leu
385                 390                 395                 400

aaa cac aaa acg ctc cca ggt tcg att aat gtc gac cag cca cct ttg    1248
Lys His Lys Thr Leu Pro Gly Ser Ile Asn Val Asp Gln Pro Pro Leu
                405                 410                 415

ttg tat gac ggt act caa att caa gac tct tct tta tat atc aac aag    1296
Leu Tyr Asp Gly Thr Gln Ile Gln Asp Ser Ser Leu Tyr Ile Asn Lys
            420                 425                 430

aca aat aga cca tgg ttt acg caa aac aag ctt ccg cgt cgg gct ggt    1344
Thr Asn Arg Pro Trp Phe Thr Gln Asn Lys Leu Pro Arg Arg Ala Gly
            435                 440                 445

gtc tca agt ttt gga ttt gga ggt gca aac tac cac gcg gtt ctg gaa    1392
Val Ser Ser Phe Gly Phe Gly Gly Ala Asn Tyr His Ala Val Leu Glu
        450                 455                 460

gaa ttc gag ccc gag cat gaa aaa cca tac cgc ctc aat act gtt gga    1440
Glu Phe Glu Pro Glu His Glu Lys Pro Tyr Arg Leu Asn Thr Val Gly
465                 470                 475                 480

cat cct gtc ctc ttg tac gct ccg tct gtg gaa gcc ctc aaa gta ctt    1488
His Pro Val Leu Leu Tyr Ala Pro Ser Val Glu Ala Leu Lys Val Leu
                485                 490                 495

tgc aac gac cag                                                    1500
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Cys Asn Asp Gln
                500

<210>   41
<211>   500
<212>   PRT
<213>   Thraustochytrium sp.

<400>   41

Met Lys Asp Met Glu Asp Arg Arg Val Ala Ile Val Gly Met Ser Ala
1   5   10   15

His Leu Pro Cys Gly Thr Asp Val Lys Glu Ser Trp Gln Ala Ile Arg
                20   25   30

Asp Gly Ile Asp Cys Leu Ser Asp Leu Pro Ala Asp Arg Leu Asp Val
            35   40   45

Thr Ala Tyr Tyr Asn Pro Asn Lys Ala Thr Lys Asp Lys Ile Tyr Cys
    50   55   60

Lys Arg Gly Gly Phe Ile Pro Asn Tyr Asp Phe Asp Pro Arg Glu Phe
65   70   75   80

Gly Leu Asn Met Phe Gln Met Glu Asp Ser Asp Ala Asn Gln Thr Leu
                85   90   95

Thr Leu Leu Lys Val Lys Gln Ala Leu Glu Asp Ala Ser Ile Glu Pro
                100   105   110

Phe Thr Lys Glu Lys Lys Asn Ile Gly Cys Val Leu Gly Ile Gly Gly
            115   120   125

Gly Gln Lys Ala Ser His Glu Phe Tyr Ser Arg Leu Asn Tyr Val Val
    130   135   140

Val Glu Lys Val Leu Arg Lys Met Gly Leu Pro Asp Ala Asp Val Glu
145   150   155   160

Glu Ala Val Glu Lys Tyr Lys Ala Asn Phe Pro Glu Trp Arg Leu Asp
                165   170   175

Ser Phe Pro Gly Phe Leu Gly Asn Val Thr Ala Gly Arg Cys Ser Asn
                180   185   190

Thr Phe Asn Met Glu Gly Met Asn Cys Val Val Asp Ala Ala Cys Ala
            195   200   205

Ser Ser Leu Ile Ala Ile Lys Val Ala Val Glu Glu Leu Leu Phe Gly
    210   215   220

Asp Cys Asp Thr Met Ile Ala Gly Ala Thr Cys Thr Asp Asn Ser Leu

                            130

Gly Met Tyr Met Ala Phe Ser Lys Thr Pro Val Phe Ser Thr Asp Pro
            245   250   255

Ser Val Arg Ala Tyr Asp Glu Lys Thr Lys Gly Met Leu Ile Gly Glu
            260   265   270

Gly Ser Ala Met Phe Val Leu Lys Arg Tyr Ala Asp Ala Val Arg Asp
            275   280   285

Gly Asp Thr Ile His Ala Val Leu Arg Ser Cys Ser Ser Ser Ser Asp
    290   295   300

Gly Lys Ala Ala Gly Ile Tyr Thr Pro Thr Ile Ser Gly Gln Glu Glu
305   310   315   320

Ala Leu Arg Arg Ala Tyr Ala Arg Ala Gly Val Cys Pro Ser Thr Ile
            325   330   335

Gly Leu Val Glu Gly His Gly Thr Gly Thr Pro Val Gly Asp Arg Ile
            340   345   350

Glu Leu Thr Ala Leu Arg Asn Leu Phe Asp Lys Ala Phe Gly Ser Lys
            355   360   365

Lys Glu Gln Ile Ala Val Gly Ser Ile Lys Ser Gln Ile Gly His Leu
    370   375   380

Lys Ser Val Ala Gly Phe Ala Gly Leu Val Lys Ala Val Leu Ala Leu
385   390   395   400

Lys His Lys Thr Leu Pro Gly Ser Ile Asn Val Asp Gln Pro Pro Leu
            405   410   415

Leu Tyr Asp Gly Thr Gln Ile Gln Asp Ser Ser Leu Tyr Ile Asn Lys
            420   425   430

Thr Asn Arg Pro Trp Phe Thr Gln Asn Lys Leu Pro Arg Arg Ala Gly
            435   440   445

Val Ser Ser Phe Gly Phe Gly Gly Ala Asn Tyr His Ala Val Leu Glu
    450   455   460

Glu Phe Glu Pro Glu His Glu Lys Pro Tyr Arg Leu Asn Thr Val Gly
465   470   475   480

His Pro Val Leu Leu Tyr Ala Pro Ser Val Glu Ala Leu Lys Val Leu
            485   490   495

Cys Asn Asp Gln

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<210>   42
<211>   1500
<212>   DNA
<213>   Thraustochytrium sp.


<220>
<221>   CDS
<222>   (1)..(1500)


<400>  42
ctt gcg gag ctc aca att gca ttg gaa gag gca aaa aca cat aaa aat      48
Leu Ala Glu Leu Thr Ile Ala Leu Glu Glu Ala Lys Thr His Lys Asn
1               5                   10                  15

gtt gac aaa gtt tgt ggc tac aag ttt att gac gaa ttt cag ctc caa      96
Val Asp Lys Val Cys Gly Tyr Lys Phe Ile Asp Glu Phe Gln Leu Gln
                20                  25                  30

gga agc tgt cct cca gaa aat ccg aga gta gga ttt tta gca aca ctg     144
Gly Ser Cys Pro Pro Glu Asn Pro Arg Val Gly Phe Leu Ala Thr Leu
            35                  40                  45

cct act tca aat atc att gtc gcg ctt aag gca att ctc gcg cag ctt     192
Pro Thr Ser Asn Ile Ile Val Ala Leu Lys Ala Ile Leu Ala Gln Leu
        50                  55                  60

gat gca aaa cca gat gcg aag aaa tgg gat ttg cct cat aaa aag gct     240
Asp Ala Lys Pro Asp Ala Lys Lys Trp Asp Leu Pro His Lys Lys Ala
65                  70                  75                  80

ttt ggg gct acc ttc gca tcg tct tca gtg aaa ggc tct gtt gct gcg     288
Phe Gly Ala Thr Phe Ala Ser Ser Ser Val Lys Gly Ser Val Ala Ala
                85                  90                  95

ctc ttc gca gga cag ggt acc cag tac tta aac atg ttc tct gat gtg     336
Leu Phe Ala Gly Gln Gly Thr Gln Tyr Leu Asn Met Phe Ser Asp Val
            100                 105                 110

gca atg aac tgg cca ccg ttc cgt gac agc att gtc gca atg gaa gaa     384
Ala Met Asn Trp Pro Pro Phe Arg Asp Ser Ile Val Ala Met Glu Glu
            115                 120                     125

gct caa act gag gta ttt gag ggc caa gtt gaa cca att agc aaa gtt     432
Ala Gln Thr Glu Val Phe Glu Gly Gln Val Glu Pro Ile Ser Lys Val
        130                 135                 140

ctg ttt cca cga gag cgc tat gca tcc gaa agt gaa cag ggg aat gaa     480
Leu Phe Pro Arg Glu Arg Tyr Ala Ser Glu Ser Glu Gln Gly Asn Glu
145                 150                 155                 160

ctt ctt tgc tta aca gag tac tct cag cca act acg ata gca gcc gca     528
Leu Leu Cys Leu Thr Glu Tyr Ser Gln Pro Thr Thr Ile Ala Ala Ala
                165                 170                 175

gta ggg gcc ttc gat att ttc aaa gcg gct ggc ttt aag cca gac atg     576
Val Gly Ala Phe Asp Ile Phe Lys Ala Ala Gly Phe Lys Pro Asp Met
            180                 185                 190

gtt gga ggg cat tca ctt ggc gaa ttt gct gct ttg tac gcg gct ggg     624
Val Gly Gly His Ser Leu Gly Glu Phe Ala Ala Leu Tyr Ala Ala Gly
            195                 200                 205

tcc att tcg cgt gac gac ctg tac aag ctt gtg tgc aaa cgg gca aag     672
Ser Ile Ser Arg Asp Asp Leu Tyr Lys Leu Val Cys Lys Arg Ala Lys
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gca atg gcg aac gct agt gac gga gct atg gca gca gtg att ggc cca      720
Ala Met Ala Asn Ala Ser Asp Gly Ala Met Ala Ala Val Ile Gly Pro
225                 230                 235                 240

gat gca cgt cta gtt acg cca caa aat agt gac gtt tat gtc gca aac      768
Asp Ala Arg Leu Val Thr Pro Gln Asn Ser Asp Val Tyr Val Ala Asn
                245                 250                 255

ttc aac tcc gca act caa gta gtc atc agt ggc act gtt caa ggt gtg      816
Phe Asn Ser Ala Thr Gln Val Val Ile Ser Gly Thr Val Gln Gly Val
                260                 265                 270

aaa gaa gag tcg aaa ttg ctc att tca aag ggg ttc cgc gta ctg cca      864
Lys Glu Glu Ser Lys Leu Leu Ile Ser Lys Gly Phe Arg Val Leu Pro
            275                 280                 285

ctt aaa tgc cag ggc gcc ttc cat tct cct ttg atg ggg cct tct gag      912
Leu Lys Cys Gln Gly Ala Phe His Ser Pro Leu Met Gly Pro Ser Glu
        290                 295                 300

gat agt ttc aaa tca ctt gtg gag act tgt acc atc tcg ccg cca aaa      960
Asp Ser Phe Lys Ser Leu Val Glu Thr Cys Thr Ile Ser Pro Pro Lys
305                 310                 315                 320

aat gtg aaa ttc ttt tgc aat gtt agt ggc aag gaa agc cca aac cca     1008
Asn Val Lys Phe Phe Cys Asn Val Ser Gly Lys Glu Ser Pro Asn Pro
                325                 330                 335

aaa cag acc ctc aag tca cac atg acg tct agc gtt cag ttc gag gag     1056
Lys Gln Thr Leu Lys Ser His Met Thr Ser Ser Val Gln Phe Glu Glu
                340                 345                 350

cag att cgt aac atg tac gat gcc gga gca cgt gtt ttt ctg gag ttt     1104
Gln Ile Arg Asn Met Tyr Asp Ala Gly Ala Arg Val Phe Leu Glu Phe
                355                 360                 365

gga ccc cgc caa gtc ctt gca aag ctt atc gcg gaa atg ttt ccc tcg     1152
Gly Pro Arg Gln Val Leu Ala Lys Leu Ile Ala Glu Met Phe Pro Ser
        370                 375                 380

tgt aca gct atc agc gtt aac ccc gcg agc agt ggt gac agt gac gtg     1200
Cys Thr Ala Ile Ser Val Asn Pro Ala Ser Ser Gly Asp Ser Asp Val
385                 390                 395                 400

caa ctc cgc ctc gcc gcc gta aaa ttc gcg gtc tcg ggt gca gcc ctt     1248
Gln Leu Arg Leu Ala Ala Val Lys Phe Ala Val Ser Gly Ala Ala Leu
                405                 410                 415

agc acc ttt gat cca tgg gag tat cgc aag cca caa gat ctt ctt att     1296
Ser Thr Phe Asp Pro Trp Glu Tyr Arg Lys Pro Gln Asp Leu Leu Ile
                420                 425                 430

cga aaa cca cga aaa act gcc ctt gtt cta tca gca gca aca tat gtt     1344
Arg Lys Pro Arg Lys Thr Ala Leu Val Leu Ser Ala Ala Thr Tyr Val
                435                 440                 445

tcc cca aag act ctt gca gaa cgt aaa aag gct atg gaa gat atc aag     1392
Ser Pro Lys Thr Leu Ala Glu Arg Lys Lys Ala Met Glu Asp Ile Lys
        450                 455                 460

cta gta tcc att aca cca aga gat agt atg gta tca att gga aaa atc     1440
Leu Val Ser Ile Thr Pro Arg Asp Ser Met Val Ser Ile Gly Lys Ile
465                 470                 475                 480

gcg caa gaa gta cgg aca gct aaa cag cct tta gaa acc gaa att cga     1488
Ala Gln Glu Val Arg Thr Ala Lys Gln Pro Leu Glu Thr Glu Ile Arg
```

aga ctc aac aaa   1500
Arg Leu Asn Lys
            500

<210>   43
<211>   500
<212>   PRT
<213>   Thraustochytrium sp.

<400>   43

Leu Ala Glu Leu Thr Ile Ala Leu Glu Glu Ala Lys Thr His Lys Asn
1   5   10   15

Val Asp Lys Val Cys Gly Tyr Lys Phe Ile Asp Glu Phe Gln Leu Gln
            20   25   30

Gly Ser Cys Pro Pro Glu Asn Pro Arg Val Gly Phe Leu Ala Thr Leu
        35   40   45

Pro Thr Ser Asn Ile Ile Val Ala Leu Lys Ala Ile Leu Ala Gln Leu
    50   55   60

Asp Ala Lys Pro Asp Ala Lys Lys Trp Asp Leu Pro His Lys Lys Ala
65   70   75   80

Phe Gly Ala Thr Phe Ala Ser Ser Ser Val Lys Gly Ser Val Ala Ala
                85   90   95

Leu Phe Ala Gly Gln Gly Thr Gln Tyr Leu Asn Met Phe Ser Asp Val
            100   105   110

Ala Met Asn Trp Pro Pro Phe Arg Asp Ser Ile Val Ala Met Glu Glu
        115   120   125

Ala Gln Thr Glu Val Phe Glu Gly Gln Val Glu Pro Ile Ser Lys Val
    130   135   140

Leu Phe Pro Arg Glu Arg Tyr Ala Ser Glu Ser Glu Gln Gly Asn Glu
145   150   155   160

Leu Leu Cys Leu Thr Glu Tyr Ser Gln Pro Thr Thr Ile Ala Ala Ala
            165   170   175

Val Gly Ala Phe Asp Ile Phe Lys Ala Ala Gly Phe Lys Pro Asp Met
            180   185   190

Val Gly Gly His Ser Leu Gly Glu Phe Ala Ala Leu Tyr Ala Ala Gly
            195   200   205

Ser Ile Ser Arg Asp Asp Leu Tyr Lys Leu Val Cys Lys Arg Ala Lys
    210   215   220

134

```
Ala Met Ala Asn Ala Ser Asp Gly Ala Met Ala Ala Val Ile Gly Pro
225             230             235             240


Asp Ala Arg Leu Val Thr Pro Gln Asn Ser Asp Val Tyr Val Ala Asn
            245             250             255


Phe Asn Ser Ala Thr Gln Val Val Ile Ser Gly Thr Val Gln Gly Val
            260             265             270


Lys Glu Glu Ser Lys Leu Leu Ile Ser Lys Gly Phe Arg Val Leu Pro
            275             280             285


Leu Lys Cys Gln Gly Ala Phe His Ser Pro Leu Met Gly Pro Ser Glu
    290             295             300


Asp Ser Phe Lys Ser Leu Val Glu Thr Cys Thr Ile Ser Pro Pro Lys
305             310             315             320


Asn Val Lys Phe Phe Cys Asn Val Ser Gly Lys Glu Ser Pro Asn Pro
            325             330             335


Lys Gln Thr Leu Lys Ser His Met Thr Ser Ser Val Gln Phe Glu Glu
            340             345             350


Gln Ile Arg Asn Met Tyr Asp Ala Gly Ala Arg Val Phe Leu Glu Phe
            355             360             365


Gly Pro Arg Gln Val Leu Ala Lys Leu Ile Ala Glu Met Phe Pro Ser
    370             375             380


Cys Thr Ala Ile Ser Val Asn Pro Ala Ser Ser Gly Asp Ser Asp Val
385             390             395             400


Gln Leu Arg Leu Ala Ala Val Lys Phe Ala Val Ser Gly Ala Ala Leu
            405             410             415


Ser Thr Phe Asp Pro Trp Glu Tyr Arg Lys Pro Gln Asp Leu Leu Ile
            420             425             430


Arg Lys Pro Arg Lys Thr Ala Leu Val Leu Ser Ala Ala Thr Tyr Val
    435             440             445


Ser Pro Lys Thr Leu Ala Glu Arg Lys Lys Ala Met Glu Asp Ile Lys
    450             455             460


Leu Val Ser Ile Thr Pro Arg Asp Ser Met Val Ser Ile Gly Lys Ile
465             470             475             480


Ala Gln Glu Val Arg Thr Ala Lys Gln Pro Leu Glu Thr Glu Ile Arg
            485             490             495


                                135
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Arg Leu Asn Lys
            500

<210>   44
<211>   351
<212>   DNA
<213>   Thraustochytrium sp.

<220>
<221>   CDS
<222>   (1)..(351)

<400>   44
tcg acc cca gcg tca gag cgg tcg gct tca ccg ctt ttc gag aaa cgc   48
Ser Thr Pro Ala Ser Glu Arg Ser Ala Ser Pro Leu Phe Glu Lys Arg
1   5   10   15

agt tcg gtt tcg tca gca cgc ctc gct gaa gct gaa gcc gcg gta ctg   96
Ser Ser Val Ser Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu
                20   25   30

agc gtt ctc gca gac aag aca ggc tac gac agc tca atg atc gag atg   144
Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met
            35   40   45

gac atg gac ctg gag agt gag ctt ggc gtt gat agc atc aaa cgc gtg   192
Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val
    50   55   60

gag atc atg agc gag gtt caa acg ctg ctc agc gtg gaa gtc tcc gac   240
Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp
65   70   75   80

gtt gac gct ctg tca aga acc aag act gtt ggc gac gtc atc gag gcg   288
Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala
                85   90   95

atg aag ctg gaa ctc ggt gga ccc caa ggc cag act ttg acc gcg gaa   336
Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ala Glu
            100   105   110

tcg atc cgt cag cca   351
Ser Ile Arg Gln Pro
            115

<210>   45
<211>   117
<212>   PRT
<213>   Thraustochytrium sp.

<400>   45

Ser Thr Pro Ala Ser Glu Arg Ser Ala Ser Pro Leu Phe Glu Lys Arg
1   5   10   15

Ser Ser Val Ser Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu
                20   25   30

Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met
            35   40   45

Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val

136

```
Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp
65              70              75              80


Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala
            85              90              95


Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ala Glu
            100             105             110


Ser Ile Arg Gln Pro
        115
```

```
<210>  46
<211>  5
<212>  PRT
<213>  Thraustochytrium sp.


<220>
<221>  MISC_FEATURE
<222>  (1)..(5)
<223>  Xaa = any amino acid

<400>  46

Leu Gly Xaa Asp Ser
1               5


<210>  47
<211>  2790
<212>  DNA
<213>  Thraustochytrium sp.


<220>
<221>  CDS
<222>  (1)..(2790)

<400>  47
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tcg acc cca gcg tca gag cgg tcg gct tca ccg ctt ttc gag aaa cgc     48
Ser Thr Pro Ala Ser Glu Arg Ser Ala Ser Pro Leu Phe Glu Lys Arg
1               5               10              15

agt tcg gtt tcg tca gca cgc ctc gct gaa gct gaa gcc gcg gta ctg     96
Ser Ser Val Ser Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu
            20              25              30

agc gtt ctc gca gac aag aca ggc tac gac agc tca atg atc gag atg     144
Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met
        35              40              45

gac atg gac ctg gag agt gag ctt ggc gtt gat agc atc aaa cgc gtg     192
Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val
    50              55              60

gag atc atg agc gag gtt caa acg ctg ctc agc gtg gaa gtc tcc gac     240
Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp
65              70              75              80

gtt gac gct ctg tca aga acc aag act gtt ggc gac gtc atc gag gcg     288
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137

```
Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala
              85                90              95

atg aag ctg gaa ctc ggt gga ccc caa ggc cag act ttg acc gcg gaa      336
Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ala Glu
              100             105             110

tcg atc cgt cag cca ccg gtg tcc gag cct gct gta ccg acc tca tcg      384
Ser Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val Pro Thr Ser Ser
              115             120             125

tca agc agt att gct aat gtt tcg tca gca cgc ctc gct gaa gct gaa      432
Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu Ala Glu Ala Glu
              130             135             140

gct gcg gta ctg agc gtt ctc gca gac aag aca ggc tac gac agc tca      480
Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser
145             150             155             160

atg atc gag atg gac atg gac ctg gag agc gag ctt ggc gtt gat agc      528
Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser
              165             170             175

atc aaa cgc gtg gag atc atg agc gag gtt caa acg ctg ctc agc gtg      576
Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val
              180             185             190

gaa gtc tcc gac gtt gac gct ctg tca aga act aag act gtt ggc gac      624
Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp
              195             200             205

gtc atc gag gcg atg aag ctg gaa ctc ggt gga ccc caa ggc cag act      672
Val Ile Glu Ala Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr
              210             215             220

ttg acc gcg gaa tcg atc cgt cag cca ccg gtg tct gag cct gct gta      720
Leu Thr Ala Glu Ser Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val
225             230             235             240

ccg acc tca tcg tca agc agt att gct aat gtt tcg tca gca cgc ctc      768
Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu
              245             250             255

gct gaa gct gaa gcg gcg gta ctg agc gtt ctc gca gac aag aca ggc      816
Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly
              260             265             270

tac gac agc tca atg atc gag atg gac atg gac ctg gag agc gag ctt      864
Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu
              275             280             285

ggc gtc gac agc atc aaa cgc gtg gag atc atg agc gag gtt caa acg      912
Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Thr
              290             295             300

ctg ctc agc gtg gaa gtc tcc gac gtt gac gct ctg tca aga acc aag      960
Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys
305             310             315             320

act gtt ggc gac gtc atc gag gcg atg aag ctg gaa ctc ggt gga ccc     1008
Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu Leu Gly Gly Pro
              325             330             335

caa ggc cag act ttg acc gcg gaa tcg atc cgt cag cca ccg gtg tcc     1056
Gln Gly Gln Thr Leu Thr Ala Glu Ser Ile Arg Gln Pro Pro Val Ser
              340             345             350

gag cct gct gta ccg acc tca tcg tca agc agt att gct aat gtt ttg     1104
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138

```
                    Glu Pro Ala Val Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Leu
                        355             360             365

tca gca cgc ctc gct gaa gct gaa gcc gcg gta ctg agc gtt ctc gca          1152
Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala
    370             375             380

gac aag aca ggc tac gac agc tca atg atc gag atg gac atg gac ctg          1200
Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu
385             390             395             400

gag agc gag ctt ggc gtt gat agc atc aaa cgc gtg gag atc atg agc          1248
Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser
            405             410             415

gag gtt caa acg ttg ctc agc gtg gaa gtc tcc gac gtt gac gct ctg          1296
Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu
        420             425             430

tca aga acc aag act gtt ggc gac gtc atc gag gcg atg aag ctg gaa          1344
Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu
        435             440             445

ctc ggt gga ccc caa ggc cag act ttg acc gcg gaa tcg atc cgt cag          1392
Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ala Glu Ser Ile Arg Gln
    450             455             460

cca ccg gtg tct gag cct gct gta ccg acc tca tcg tca agc agt att          1440
Pro Pro Val Ser Glu Pro Ala Val Pro Thr Ser Ser Ser Ser Ser Ile
465             470             475             480

gct aat gtt tcg tca gca cgc ctc gct gaa gct gaa gcc gcg gta ctg          1488
Ala Asn Val Ser Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu
            485             490             495

agc gtt ctc gca gac aag aca ggc tac gac agc tca atg atc gag atg          1536
Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met
            500             505             510

gac atg gac ctg gag agt gag ctt ggc gtc gac agc atc aaa cgc gtg          1584
Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val
            515             520             525

gag atc atg agc gag gtt caa acg ctg ctc agc gtg gaa gtc tcc gac          1632
Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp
    530             535             540

gtt gac gct ctg tca aga acc aag act gtt ggc gac gtc atc gag gcg          1680
Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala
545             550             555             560

atg aag ctg gaa ctc ggt gga ccc caa ggc cag act ttg acc tct gaa          1728
Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ser Glu
            565             570             575

ccg atc cat cag cca cca gtg tcc gag cct gct gta ccg acc tca tcg          1776
Pro Ile His Gln Pro Pro Val Ser Glu Pro Ala Val Pro Thr Ser Ser
            580             585             590

tca agc agt att gct aat gtt tct tca gca cgc ctc gct gaa gct gaa          1824
Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu Ala Glu Ala Glu
            595             600             605

gcc gcg gta ctg agc gtt ctc gca gac aag aca ggc tac gac agc tca          1872
Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser
    610             615             620

atg atc gag atg gac atg gac ctg gag agc gag ctt ggc gtt gat agc          1920
```

139

```
        Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser
        625                 630                 635                 640

atc aaa cgc gtg gaa atc atg agc gag gtt caa acg ctg ctc agc gtg          1968
Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val
                    645                 650                 655

gaa gtc tcc gac gtt gac gct ctg tca aga acc aag act gtt ggc gac          2016
Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp
                660                 665                 670

gtc atc gag gcg atg aag atg gaa ctc ggt gga ccc caa ggc cag act          2064
Val Ile Glu Ala Met Lys Met Glu Leu Gly Gly Pro Gln Gly Gln Thr
            675                 680                 685

ttg acc gcg gaa tcg atc cgt cag cca ccg gtg tct gag cct gct gta          2112
Leu Thr Ala Glu Ser Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val
        690                 695                 700

ccg acc tca tcg tca agc agt att gct aat gtt tcg tca gca cgc ctc          2160
Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu
705                 710                 715                 720

gct gaa gct gaa gcg gcg gta ctg agc gtt ctc gca gac aag aca ggc          2208
Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly
                725                 730                 735

tac gac agc tca atg atc gag atg gac atg gac ctg gag agc gag ctt          2256
Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu
                740                 745                 750

ggc gtt gat agc atc aaa cgc gtg gag atc atg agc gag gtt caa gcg          2304
Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Ala
            755                 760                 765

ctg ctc agc gtg gaa gtc tcc gac gtt gac gct ctg tca aga acc aag          2352
Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys
        770                 775                 780

act gtt ggc gac gtc atc gag gcg atg aag atg gaa ctc ggt gga ccc          2400
Thr Val Gly Asp Val Ile Glu Ala Met Lys Met Glu Leu Gly Gly Pro
785                 790                 795                 800

caa ggc cag act ttg acc gca gaa tcg atc cgt gag cca ccg gtg tct          2448
Gln Gly Gln Thr Leu Thr Ala Glu Ser Ile Arg Glu Pro Pro Val Ser
                805                 810                 815

gag cct gct gta ccg acc tca tcg tca agt agt atc gct aat gtt tct          2496
Glu Pro Ala Val Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser
            820                 825                 830

tca gct cgc ctc gct gaa gct gaa gcc gcg gta ctg agc gtt ctc gca          2544
Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala
            835                 840                 845

gac aag aca ggc tac gac agc tca atg atc gag atg gac atg gac ctg          2592
Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu
            850                 855                 860

gag agt gag ctt ggc gtc gac agc atc aaa cgc gtg gag atc atg agc          2640
Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser
865                 870                 875                 880

gag gtt caa acg ttg ctc agc gtg gaa gtc tcc gac gtt gac gct ctg          2688
Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu
                885                 890                 895

tca aga acc aag act gtt ggc gac gtc atc gag gcg atg aag ctg gaa          2736
Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu
```

140

```
Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu
            900                 905                 910

ctt ggg gaa tca tca agt att gag act ctc aat tgt acc gag gtt gag      2784
Leu Gly Glu Ser Ser Ser Ile Glu Thr Leu Asn Cys Thr Glu Val Glu
            915                 920                 925

cac acg                                                              2790
His Thr
    930
```

<210> 48
<211> 930
<212> PRT
<213> Thraustochytrium sp.

<400> 48

```
Ser Thr Pro Ala Ser Glu Arg Ser Ala Ser Pro Leu Phe Glu Lys Arg
1               5                   10                  15


Ser Ser Val Ser Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu
            20                  25                  30


Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met
            35                  40                  45


Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val
    50                  55                  60


Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp
65                  70                  75                  80


Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala
            85                  90                  95


Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ala Glu
            100                 105                 110


Ser Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val Pro Thr Ser Ser
            115                 120                 125


Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu Ala Glu Ala Glu
    130                 135                 140


Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser
145                 150                 155                 160


Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser
                165                 170                 175


Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val
            180                 185                 190


Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp
```

141

Val Ile Glu Ala Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr
    210   215   220

Leu Thr Ala Glu Ser Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val
225   230   235   240

Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu
        245   250   255

Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly
        260   265   270

Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu
        275   280   285

Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Thr
    290   295   300

Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys
305   310   315   320

Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu Leu Gly Gly Pro
        325   330   335

Gln Gly Gln Thr Leu Thr Ala Glu Ser Ile Arg Gln Pro Pro Val Ser
        340   345   350

Glu Pro Ala Val Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Leu
        355   360   365

Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala
    370   375   380

Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu
385   390   395   400

Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser
        405   410   415

Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu
        420   425   430

Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu
        435   440   445

Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ala Glu Ser Ile Arg Gln
    450   455   460

Pro Pro Val Ser Glu Pro Ala Val Pro Thr Ser Ser Ser Ser Ser Ile

142

Ala Asn Val Ser Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu
            485   490   495

Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met
            500   505   510

Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val
            515   520   525

Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp
    530   535   540

Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala
545   550   555   560

Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ser Glu
            565   570   575

Pro Ile His Gln Pro Pro Val Ser Glu Pro Ala Val Pro Thr Ser Ser
            580   585   590

Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu Ala Glu Ala Glu
            595   600   605

Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser
    610   615   620

Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser
625   630   635   640

Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val
            645   650   655

Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp
            660   665   670

Val Ile Glu Ala Met Lys Met Glu Leu Gly Gly Pro Gln Gly Gln Thr
            675   680   685

Leu Thr Ala Glu Ser Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val
    690   695   700

Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu
705   710   715   720

Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly
            725   730   735

Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu

143

```
Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Ala
        755                    760                    765

Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys
    770                    775                    780

Thr Val Gly Asp Val Ile Glu Ala Met Lys Met Glu Leu Gly Gly Pro
785                    790                    795                    800

Gln Gly Gln Thr Leu Thr Ala Glu Ser Ile Arg Glu Pro Pro Val Ser
                805                    810                    815

Glu Pro Ala Val Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser
                820                    825                    830

Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala
        835                    840                    845

Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu
    850                    855                    860

Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser
865                    870                    875                    880

Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu
                885                    890                    895

Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu
                900                    905                    910

Leu Gly Glu Ser Ser Ser Ile Glu Thr Leu Asn Cys Thr Glu Val Glu
        915                    920                    925

His Thr
    930
```

```
<210>   49
<211>   2433
<212>   DNA
<213>   Thraustochytrium sp.


<220>
<221>   CDS
<222>   (1)..(2433)

<400>   49
aaa agt gtc aag gct tca ggg tgt gag aat gta gat acc cgt ttc gct        48
Lys Ser Val Lys Ala Ser Gly Cys Glu Asn Val Asp Thr Arg Phe Ala
1               5                   10                  15

aag gtt gta caa atc tcg ctt cct agc aag ctg aaa tcc act gtg tcg        96
Lys Val Val Gln Ile Ser Leu Pro Ser Lys Leu Lys Ser Thr Val Ser
```

```
cac gat cga cct gta att gtt gta gat gat gga acg ccc tta acc acg    144
His Asp Arg Pro Val Ile Val Val Asp Asp Gly Thr Pro Leu Thr Thr
        35              40                  45

gag ctt tgt aaa att ctt ggg ggt aat att gtg gtt ctc tct tat caa    192
Glu Leu Cys Lys Ile Leu Gly Gly Asn Ile Val Val Leu Ser Tyr Gln
    50                  55                  60

ggg aag ccc gct ggt cca cgg gga gtc gag gtg cca gat ctt tcc gag    240
Gly Lys Pro Ala Gly Pro Arg Gly Val Glu Val Pro Asp Leu Ser Glu
65                  70                  75                  80

gaa gcc cta att caa gct ctt gca ttg att cgg tct aca tat gga gtt    288
Glu Ala Leu Ile Gln Ala Leu Ala Leu Ile Arg Ser Thr Tyr Gly Val
                85                  90                  95

cca att ggt ttt att tgt cag caa gtg tct aat gtg agc acc aag gca    336
Pro Ile Gly Phe Ile Cys Gln Gln Val Ser Asn Val Ser Thr Lys Ala
                100                 105                 110

cag ctt tgt tgg gca ctc ctc gca gcg aag cat ctc aag aag gat ttg    384
Gln Leu Cys Trp Ala Leu Leu Ala Ala Lys His Leu Lys Lys Asp Leu
        115                 120                 125

aat gct gtc tta ccc gat tca aga tcc ttc ttc gtc gga gtt gta cgc    432
Asn Ala Val Leu Pro Asp Ser Arg Ser Phe Phe Val Gly Val Val Arg
    130                 135                 140

ttg aac ggg aaa ctt gga act ttc gaa aac atc agc gac ttc tct aaa    480
Leu Asn Gly Lys Leu Gly Thr Phe Glu Asn Ile Ser Asp Phe Ser Lys
145                 150                 155                 160

ttt gat ttg acg aaa gcc cta gat tac gga cag cgt ggt tct ctc tta    528
Phe Asp Leu Thr Lys Ala Leu Asp Tyr Gly Gln Arg Gly Ser Leu Leu
                165                 170                 175

ggc ctg tgc aag tca cta gac tta gaa tgg gaa cag gtg ttt tgc cgt    576
Gly Leu Cys Lys Ser Leu Asp Leu Glu Trp Glu Gln Val Phe Cys Arg
                180                 185                 190

gga ata gat ctt gcg tgt gat ctt atg cca ctc cag gcc gca agg ata    624
Gly Ile Asp Leu Ala Cys Asp Leu Met Pro Leu Gln Ala Ala Arg Ile
                195                 200                 205

ctc aga aat gag ctt cag tgt ccc aat atg cgc ctt cgc gag gtt ggg    672
Leu Arg Asn Glu Leu Gln Cys Pro Asn Met Arg Leu Arg Glu Val Gly
    210                 215                 220

tac gat att tct ggc gcc agg tac acc att tca acc gat gac ctg cta    720
Tyr Asp Ile Ser Gly Ala Arg Tyr Thr Ile Ser Thr Asp Asp Leu Leu
225                 230                 235                 240

tgt gga ccc tcg aag gct aaa gta gag gcc gca gac ttg ttt ctt gtg    768
Cys Gly Pro Ser Lys Ala Lys Val Glu Ala Ala Asp Leu Phe Leu Val
                245                 250                 255

aca ggt ggc gca cga ggt att aca cct cat tgt gtt cgt gag att gca    816
Thr Gly Gly Ala Arg Gly Ile Thr Pro His Cys Val Arg Glu Ile Ala
                260                 265                 270

agt cga tcc ccc gga acc aca ttt gtg ctg gtt gga aga agc gaa atg    864
Ser Arg Ser Pro Gly Thr Thr Phe Val Leu Val Gly Arg Ser Glu Met
        275                 280                 285

tcc gac gag cct gac tgg gct gtt ggc cac tac aat aaa gac ctg gac    912
Ser Asp Glu Pro Asp Trp Ala Val Gly His Tyr Asn Lys Asp Leu Asp
```

```
caa agc aca atg aaa cac ttg aaa gca acg cat gct gct gga ggg gta      960
Gln Ser Thr Met Lys His Leu Lys Ala Thr His Ala Ala Gly Gly Val
305             310             315             320
```

```
aaa cct acg cct aaa gca cat cgt gca ctt gtg aac agg gtc act ggc      1008
Lys Pro Thr Pro Lys Ala His Arg Ala Leu Val Asn Arg Val Thr Gly
                325             330             335
```

```
tca cgg gag gta cga gaa tct ctt aga gca atc cag gag gca ggg gca      1056
Ser Arg Glu Val Arg Glu Ser Leu Arg Ala Ile Gln Glu Ala Gly Ala
            340             345             350
```

```
aat gtc gaa tat atc gcc tgt gat gtt tcg gat gaa aac aag gtc cgc      1104
Asn Val Glu Tyr Ile Ala Cys Asp Val Ser Asp Glu Asn Lys Val Arg
            355             360             365
```

```
caa ctt gtg caa aga gtg gag caa aag tat ggc tgt gaa ata act ggg      1152
Gln Leu Val Gln Arg Val Glu Gln Lys Tyr Gly Cys Glu Ile Thr Gly
            370             375             380
```

```
att tgg cat gca agc ggg gtt ctt cgt gac aaa ctt gtc gag caa aag      1200
Ile Trp His Ala Ser Gly Val Leu Arg Asp Lys Leu Val Glu Gln Lys
385             390             395             400
```

```
act aca gac gac ttt gag gca gtt ttt ggg acc aag gtg act ggc ctt      1248
Thr Thr Asp Asp Phe Glu Ala Val Phe Gly Thr Lys Val Thr Gly Leu
                405             410             415
```

```
gta aac atc gtg tca caa gtc aat atg tct aag cta cga cac ttc atc      1296
Val Asn Ile Val Ser Gln Val Asn Met Ser Lys Leu Arg His Phe Ile
            420             425             430
```

```
ctc ttc agt tct ttg gct gga ttt cat ggg aac aag ggc caa acg gat      1344
Leu Phe Ser Ser Leu Ala Gly Phe His Gly Asn Lys Gly Gln Thr Asp
            435             440             445
```

```
tat gca att gct aat gaa gcc ttg aac aaa atc gcg cat act ctc tca      1392
Tyr Ala Ile Ala Asn Glu Ala Leu Asn Lys Ile Ala His Thr Leu Ser
            450             455             460
```

```
gcg ttt ttg ccc aaa ctg aat gca aag gtg cta gac ttc ggt ccg tgg      1440
Ala Phe Leu Pro Lys Leu Asn Ala Lys Val Leu Asp Phe Gly Pro Trp
465             470             475             480
```

```
gta ggt tca gga atg gta acc gaa aca ctt gag aag cat ttt aaa gct      1488
Val Gly Ser Gly Met Val Thr Glu Thr Leu Glu Lys His Phe Lys Ala
                485             490             495
```

```
atg ggg gtt cag act att cct ctc gag cca gga gca cgg act gtt gcg      1536
Met Gly Val Gln Thr Ile Pro Leu Glu Pro Gly Ala Arg Thr Val Ala
                500             505             510
```

```
caa atc att ttg gca agt tcg cca ccg caa tcg ctt ttg ggg aac tgg      1584
Gln Ile Ile Leu Ala Ser Ser Pro Pro Gln Ser Leu Leu Gly Asn Trp
            515             520             525
```

```
ggc ttt cca gcc acc aaa ccg cta caa cgc tct aat gta gtc acg ggc      1632
Gly Phe Pro Ala Thr Lys Pro Leu Gln Arg Ser Asn Val Val Thr Gly
            530             535             540
```

```
aca ctc tct ccg gaa gag ata gaa ttc atc gca gac cac aaa att caa      1680
Thr Leu Ser Pro Glu Glu Ile Glu Phe Ile Ala Asp His Lys Ile Gln
545             550             555             560
```

```
ggc cgc aag gtg ctt ccc atg atg gct gca atc ggg ttc atg gcc tct      1728
Gly Arg Lys Val Leu Pro Met Met Ala Ala Ile Gly Phe Met Ala Ser
```

```
att gcg gaa gga ctc tac ccg ggg tac aat ctg caa ggc gtg gaa aat    1776
Ile Ala Glu Gly Leu Tyr Pro Gly Tyr Asn Leu Gln Gly Val Glu Asn
        580                 585                 590

gct cag ctc ttt caa ggc ttg act atc aac caa gag aca aaa ttt caa    1824
Ala Gln Leu Phe Gln Gly Leu Thr Ile Asn Gln Glu Thr Lys Phe Gln
        595                 600                  605

atc act ctc att gag gag cac aac tct gag gaa aac ctg gat gtc ctg    1872
Ile Thr Leu Ile Glu Glu His Asn Ser Glu Glu Asn Leu Asp Val Leu
        610                 615                 620

aca tcc ctt ggt gta atg ttg gaa agc ggg aag gtg ctt ccc gct tac    1920
Thr Ser Leu Gly Val Met Leu Glu Ser Gly Lys Val Leu Pro Ala Tyr
625                 630                 635                 640

cga tgt gtt gta tgc ttg aat aca acc cag cag cag ccc aag cta tct    1968
Arg Cys Val Val Cys Leu Asn Thr Thr Gln Gln Gln Pro Lys Leu Ser
                645                 650                 655

cca aaa att ctt aac ttg gaa gtt gac cct gca tgc gag gtt aac ccc    2016
Pro Lys Ile Leu Asn Leu Glu Val Asp Pro Ala Cys Glu Val Asn Pro
                660                 665                 670

tat gat gga aag tcg ttg ttc cac ggt ccg ctt ttg caa ttc gtt caa    2064
Tyr Asp Gly Lys Ser Leu Phe His Gly Pro Leu Leu Gln Phe Val Gln
                675                 680                 685

caa gtg ttg cac tca agt acc aaa ggc ctc gtt gcc aag tgc cgc gcg    2112
Gln Val Leu His Ser Ser Thr Lys Gly Leu Val Ala Lys Cys Arg Ala
        690                 695                 700

ctt cca atc aaa gaa gcc atc cga ggg cca ttt atc aag caa aca ctc    2160
Leu Pro Ile Lys Glu Ala Ile Arg Gly Pro Phe Ile Lys Gln Thr Leu
705                 710                 715                 720

cat gat cca att cta gac gac gtc att ttt cag cta atg ctc gtg tgg    2208
His Asp Pro Ile Leu Asp Asp Val Ile Phe Gln Leu Met Leu Val Trp
                725                 730                 735

tgt cgt aat gct cta gga agt gca tcg cta ccc aac aga att gaa aag    2256
Cys Arg Asn Ala Leu Gly Ser Ala Ser Leu Pro Asn Arg Ile Glu Lys
                740                 745                 750

atg tca tac ttt ggg aat gtc tca gaa ggt agc act ttc ttt gcc tca    2304
Met Ser Tyr Phe Gly Asn Val Ser Glu Gly Ser Thr Phe Phe Ala Ser
                755                 760                 765

gtt aca cct gtg gga cca aga gta cca aag gat ccc gtg atc aaa atg    2352
Val Thr Pro Val Gly Pro Arg Val Pro Lys Asp Pro Val Ile Lys Met
        770                 775                 780

cag ttt ctt ctc caa gat gaa tcc ggc aac aca ttt tca tcg ggg gag    2400
Gln Phe Leu Leu Gln Asp Glu Ser Gly Asn Thr Phe Ser Ser Gly Glu
785                 790                 795                 800

ggc tcg gtt gtg ctt agt gac gaa ctc gtc ttt                        2433
Gly Ser Val Val Leu Ser Asp Glu Leu Val Phe
                805                 810
```

<210> 50
<211> 811
<212> PRT
<213> Thraustochytrium sp.

<400> 50

Lys Ser Val Lys Ala Ser Gly Cys Glu Asn Val Asp Thr Arg Phe Ala
1   5   10   15

Lys Val Val Gln Ile Ser Leu Pro Ser Lys Leu Lys Ser Thr Val Ser
                20   25   30

His Asp Arg Pro Val Ile Val Val Asp Asp Gly Thr Pro Leu Thr Thr
        35   40   45

Glu Leu Cys Lys Ile Leu Gly Gly Asn Ile Val Val Leu Ser Tyr Gln
    50   55   60

Gly Lys Pro Ala Gly Pro Arg Gly Val Glu Val Pro Asp Leu Ser Glu
65   70   75   80

Glu Ala Leu Ile Gln Ala Leu Ala Leu Ile Arg Ser Thr Tyr Gly Val
                85   90   95

Pro Ile Gly Phe Ile Cys Gln Gln Val Ser Asn Val Ser Thr Lys Ala
                100   105   110

Gln Leu Cys Trp Ala Leu Leu Ala Ala Lys His Leu Lys Lys Asp Leu
            115   120   125

Asn Ala Val Leu Pro Asp Ser Arg Ser Phe Phe Val Gly Val Val Arg
    130   135   140

Leu Asn Gly Lys Leu Gly Thr Phe Glu Asn Ile Ser Asp Phe Ser Lys
145   150   155   160

Phe Asp Leu Thr Lys Ala Leu Asp Tyr Gly Gln Arg Gly Ser Leu Leu
                165   170   175

Gly Leu Cys Lys Ser Leu Asp Leu Glu Trp Glu Gln Val Phe Cys Arg
            180   185   190

Gly Ile Asp Leu Ala Cys Asp Leu Met Pro Leu Gln Ala Ala Arg Ile
        195   200   205

Leu Arg Asn Glu Leu Gln Cys Pro Asn Met Arg Leu Arg Glu Val Gly
    210   215   220

Tyr Asp Ile Ser Gly Ala Arg Tyr Thr Ile Ser Thr Asp Asp Leu Leu
225   230   235   240

Cys Gly Pro Ser Lys Ala Lys Val Glu Ala Ala Asp Leu Phe Leu Val
                245   250   255

Thr Gly Gly Ala Arg Gly Ile Thr Pro His Cys Val Arg Glu Ile Ala
                260   265   270

148

Ser Arg Ser Pro Gly Thr Thr Phe Val Leu Val Gly Arg Ser Glu Met
    275   280   285

Ser Asp Glu Pro Asp Trp Ala Val Gly His Tyr Asn Lys Asp Leu Asp
    290   295   300

Gln Ser Thr Met Lys His Leu Lys Ala Thr His Ala Ala Gly Gly Val
305   310   315   320

Lys Pro Thr Pro Lys Ala His Arg Ala Leu Val Asn Arg Val Thr Gly
          325   330   335

Ser Arg Glu Val Arg Glu Ser Leu Arg Ala Ile Gln Glu Ala Gly Ala
        340   345   350

Asn Val Glu Tyr Ile Ala Cys Asp Val Ser Asp Glu Asn Lys Val Arg
        355   360   365

Gln Leu Val Gln Arg Val Glu Gln Lys Tyr Gly Cys Glu Ile Thr Gly
    370   375   380

Ile Trp His Ala Ser Gly Val Leu Arg Asp Lys Leu Val Glu Gln Lys
385   390   395   400

Thr Thr Asp Asp Phe Glu Ala Val Phe Gly Thr Lys Val Thr Gly Leu
        405   410   415

Val Asn Ile Val Ser Gln Val Asn Met Ser Lys Leu Arg His Phe Ile
        420   425   430

Leu Phe Ser Ser Leu Ala Gly Phe His Gly Asn Lys Gly Gln Thr Asp
        435   440   445

Tyr Ala Ile Ala Asn Glu Ala Leu Asn Lys Ile Ala His Thr Leu Ser
    450   455   460

Ala Phe Leu Pro Lys Leu Asn Ala Lys Val Leu Asp Phe Gly Pro Trp
465   470   475   480

Val Gly Ser Gly Met Val Thr Glu Thr Leu Glu Lys His Phe Lys Ala
        485   490   495

Met Gly Val Gln Thr Ile Pro Leu Glu Pro Gly Ala Arg Thr Val Ala
        500   505   510

Gln Ile Ile Leu Ala Ser Ser Pro Pro Gln Ser Leu Leu Gly Asn Trp
        515   520   525

Gly Phe Pro Ala Thr Lys Pro Leu Gln Arg Ser Asn Val Val Thr Gly
    530   535   540

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Thr Leu Ser Pro Glu Glu Ile Glu Phe Ile Ala Asp His Lys Ile Gln
545             550             555             560

Gly Arg Lys Val Leu Pro Met Met Ala Ala Ile Gly Phe Met Ala Ser
            565             570             575

Ile Ala Glu Gly Leu Tyr Pro Gly Tyr Asn Leu Gln Gly Val Glu Asn
        580             585             590

Ala Gln Leu Phe Gln Gly Leu Thr Ile Asn Gln Glu Thr Lys Phe Gln
        595             600             605

Ile Thr Leu Ile Glu Glu His Asn Ser Glu Glu Asn Leu Asp Val Leu
    610             615             620

Thr Ser Leu Gly Val Met Leu Glu Ser Gly Lys Val Leu Pro Ala Tyr
625             630             635             640

Arg Cys Val Val Cys Leu Asn Thr Thr Gln Gln Gln Pro Lys Leu Ser
            645             650             655

Pro Lys Ile Leu Asn Leu Glu Val Asp Pro Ala Cys Glu Val Asn Pro
            660             665             670

Tyr Asp Gly Lys Ser Leu Phe His Gly Pro Leu Leu Gln Phe Val Gln
        675             680             685

Gln Val Leu His Ser Ser Thr Lys Gly Leu Val Ala Lys Cys Arg Ala
    690             695             700

Leu Pro Ile Lys Glu Ala Ile Arg Gly Pro Phe Ile Lys Gln Thr Leu
705             710             715             720

His Asp Pro Ile Leu Asp Asp Val Ile Phe Gln Leu Met Leu Val Trp
            725             730             735

Cys Arg Asn Ala Leu Gly Ser Ala Ser Leu Pro Asn Arg Ile Glu Lys
        740             745             750

Met Ser Tyr Phe Gly Asn Val Ser Glu Gly Ser Thr Phe Phe Ala Ser
        755             760             765

Val Thr Pro Val Gly Pro Arg Val Pro Lys Asp Pro Val Ile Lys Met
    770             775             780

Gln Phe Leu Leu Gln Asp Glu Ser Gly Asn Thr Phe Ser Ser Gly Glu
785             790             795             800

Gly Ser Val Val Leu Ser Asp Glu Leu Val Phe
            805             810
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atg caa ctt cct cca gcg cat tct gcc gat gag aat cgc atc gcg gtc        48
Met Gln Leu Pro Pro Ala His Ser Ala Asp Glu Asn Arg Ile Ala Val
1               5                   10                  15

gtg ggc atg gcc gtc aaa tat gcg ggc tgt gac aat aaa gaa gag ttt        96
Val Gly Met Ala Val Lys Tyr Ala Gly Cys Asp Asn Lys Glu Glu Phe
                20                  25                  30

tgg aag act ttg atg aat ggt agt atc aat acc aag tcg att tcg gca       144
Trp Lys Thr Leu Met Asn Gly Ser Ile Asn Thr Lys Ser Ile Ser Ala
            35                  40                  45

gca agg ttg ggc agc aat aag cgt gac gaa cac tat gtt cct gaa cga       192
Ala Arg Leu Gly Ser Asn Lys Arg Asp Glu His Tyr Val Pro Glu Arg
        50                  55                  60

tcg aaa tat gca gat acg ttc tgt aac gaa agg tac ggt tgt atc cag       240
Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Arg Tyr Gly Cys Ile Gln
65                  70                  75                  80

caa ggt acg gat aat gag cat gac ctc ctc cta ggt ctt gct caa gaa       288
Gln Gly Thr Asp Asn Glu His Asp Leu Leu Leu Gly Leu Ala Gln Glu
                85                  90                  95

gct ctc gct gac gct gcc ggg cgg atg gag aaa caa cct tcg gag gcg       336
Ala Leu Ala Asp Ala Ala Gly Arg Met Glu Lys Gln Pro Ser Glu Ala
                100                 105                 110

ttc gat ctg gaa aat act ggc atc gtg agt ggg tgc tta tct ttt cca       384
Phe Asp Leu Glu Asn Thr Gly Ile Val Ser Gly Cys Leu Ser Phe Pro
            115                 120                 125

atg gat aac ctg caa gga gag ttg ttg aac ttg tat caa agc cat gtg       432
Met Asp Asn Leu Gln Gly Glu Leu Leu Asn Leu Tyr Gln Ser His Val
        130                 135                 140

gag aaa caa ctt cca cct agt gcc ttg gta gaa gcc gtg aag ctt tgg       480
Glu Lys Gln Leu Pro Pro Ser Ala Leu Val Glu Ala Val Lys Leu Trp
145                 150                 155                 160

tct gag cga cag aaa tct acg aaa gca cat gca ggg gac aag cgc cgg       528
Ser Glu Arg Gln Lys Ser Thr Lys Ala His Ala Gly Asp Lys Arg Arg
                165                 170                 175

ttc att gac cca gct tct ttt gta gct gat aaa ctg aac cta ggc cca       576
Phe Ile Asp Pro Ala Ser Phe Val Ala Asp Lys Leu Asn Leu Gly Pro
            180                 185                 190

cta cat tat gcg atc gat gca gca tgc gct tct gca ttg tac gtg tta       624
Leu His Tyr Ala Ile Asp Ala Ala Cys Ala Ser Ala Leu Tyr Val Leu
            195                 200                 205
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151

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aaa tta gct caa gac cac ctt gtt tca ggt gcc gtt gat atg atg tta        672
Lys Leu Ala Gln Asp His Leu Val Ser Gly Ala Val Asp Met Met Leu
    210             215             220

tgt gga gcg acg tgc ttc cca gaa cca ttc ttc atc ttg tct ggg ttc        720
Cys Gly Ala Thr Cys Phe Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe
225             230             235             240

tcg act ttt caa gcg atg cct gnt ggg gca gat gga gtc tca cta cct        768
Ser Thr Phe Gln Ala Met Pro Xaa Gly Ala Asp Gly Val Ser Leu Pro
            245             250             255

ctc cat aaa acg agt gct ggg ctc act cca ggt gaa ggg ggg tcc att        816
Leu His Lys Thr Ser Ala Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile
            260             265             270

atg gtg ctc aag cga ctg aaa gac gct atc aga gat gga aat cac att        864
Met Val Leu Lys Arg Leu Lys Asp Ala Ile Arg Asp Gly Asn His Ile
            275             280             285

tat ggt gtg ctc ctt gaa gca aat tta agt aac gca ggt tgt ggg ctt        912
Tyr Gly Val Leu Leu Glu Ala Asn Leu Ser Asn Ala Gly Cys Gly Leu
            290             295             300

cca ctc agc ccg cac tta ccg agc gaa gaa tca tgt att cgt gat acc        960
Pro Leu Ser Pro His Leu Pro Ser Glu Glu Ser Cys Ile Arg Asp Thr
305             310             315             320

tac cgc cgt gct gga gtt gct gca gat caa agt att cag tat att gag       1008
Tyr Arg Arg Ala Gly Val Ala Ala Asp Gln Ser Ile Gln Tyr Ile Glu
            325             330             335

tgc cac gct acg gga acc cct cga ggg gat gtc gtg gaa att gag gcg       1056
Cys His Ala Thr Gly Thr Pro Arg Gly Asp Val Val Glu Ile Glu Ala
            340             345             350

gtt gaa aga gtt ttc aag aaa aac gtt cca cgc tta ggc tcg acg aaa       1104
Val Glu Arg Val Phe Lys Lys Asn Val Pro Arg Leu Gly Ser Thr Lys
            355             360             365

gga aat ttt ggt cac tcg tta gtt gcg gct ggt ttc gca ggt atg gca       1152
Gly Asn Phe Gly His Ser Leu Val Ala Ala Gly Phe Ala Gly Met Ala
            370             375             380

aag ctt ctt ctt gca atg gaa cat gga gtg att cct ccc aca cca ggt       1200
Lys Leu Leu Leu Ala Met Glu His Gly Val Ile Pro Pro Thr Pro Gly
385             390             395             400

ctt gat gct tcg aac cag gca agt gag cac gtt gtg aca aag gct atc       1248
Leu Asp Ala Ser Asn Gln Ala Ser Glu His Val Val Thr Lys Ala Ile
            405             410             415

act tgg cct gag aca cat ggg gct cca aaa cga gct ggc ctt tca gca       1296
Thr Trp Pro Glu Thr His Gly Ala Pro Lys Arg Ala Gly Leu Ser Ala
            420             425             430

ttt gga ttt ggt ggg act aat gcg cat gca ctc ttc gaa gag ttt aat       1344
Phe Gly Phe Gly Gly Thr Asn Ala His Ala Leu Phe Glu Glu Phe Asn
            435             440             445

gcc gag ggc ata agt tat cgc cct gga aag cct cca gtc gaa tcg aat       1392
Ala Glu Gly Ile Ser Tyr Arg Pro Gly Lys Pro Pro Val Glu Ser Asn
    450             455             460

acc cgt cct tcc gtc gta ata act ggg atg gac tgt acc ttt ggg agc       1440
Thr Arg Pro Ser Val Val Ile Thr Gly Met Asp Cys Thr Phe Gly Ser
465             470             475                   480
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152

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ctt gaa ggg att gat gcg ttc gag act gcc ctg tac gag ggg cgt gac      1488
Leu Glu Gly Ile Asp Ala Phe Glu Thr Ala Leu Tyr Glu Gly Arg Asp
            485                 490                 495

gca gct cgt gac tta ccc gcc aaa cgt tgg agg ttc cta ggt gag gac      1536
Ala Ala Arg Asp Leu Pro Ala Lys Arg Trp Arg Phe Leu Gly Glu Asp
            500                 505                 510

ttg gag ttt ctc cga gcc atc agg ctc aag gaa aag cct agg ggt tgt      1584
Leu Glu Phe Leu Arg Ala Ile Arg Leu Lys Glu Lys Pro Arg Gly Cys
            515                 520                 525

ttt gtg gag agt gtt gac gtt aac ttt aga cgg ctg aaa acg ccc ttg      1632
Phe Val Glu Ser Val Asp Val Asn Phe Arg Arg Leu Lys Thr Pro Leu
            530                 535                 540

aca cca gaa gat atg ttg cgg ccc caa caa ctc ttg gcg gtt tct acg      1680
Thr Pro Glu Asp Met Leu Arg Pro Gln Gln Leu Leu Ala Val Ser Thr
545                 550                 555                 560

atg gac cga gca att atc gat gca ggt cta aag aag ggc caa cat gta      1728
Met Asp Arg Ala Ile Ile Asp Ala Gly Leu Lys Lys Gly Gln His Val
                565                 570                 575

gca gtt ctt gtt ggc cta gga act gac ctg gaa ctt tac cgt cat cga      1776
Ala Val Leu Val Gly Leu Gly Thr Asp Leu Glu Leu Tyr Arg His Arg
            580                 585                 590

gca aga gtc gcg ctt aaa gag gtt ttg cac ccg agc tta aag tca gac      1824
Ala Arg Val Ala Leu Lys Glu Val Leu His Pro Ser Leu Lys Ser Asp
            595                 600                 605

act gca att ctc cag aaa ata atg caa tat gtg aat gat gca gga act      1872
Thr Ala Ile Leu Gln Lys Ile Met Gln Tyr Val Asn Asp Ala Gly Thr
            610                 615                 620

tcg act tca tac aca tct tac att gga aac ctc gtt gcc acg cgt att      1920
Ser Thr Ser Tyr Thr Ser Tyr Ile Gly Asn Leu Val Ala Thr Arg Ile
625                 630                 635                 640

tcg tct cag tgg gga ttc aca ggg ccg tcc ttt act gtc aca gaa gga      1968
Ser Ser Gln Trp Gly Phe Thr Gly Pro Ser Phe Thr Val Thr Glu Gly
            645                 650                 655

aat aat tcc gtg tac aga tgt gca caa cta gcc aaa gat atg ctt cag      2016
Asn Asn Ser Val Tyr Arg Cys Ala Gln Leu Ala Lys Asp Met Leu Gln
            660                 665                 670

gtt aac cga gtt gat gct gtc gtc atc gca ggc gtt gat ctc aac gga      2064
Val Asn Arg Val Asp Ala Val Val Ile Ala Gly Val Asp Leu Asn Gly
            675                 680                 685

agc gcc gaa agt ttt ttt gtc cga gca aat cgt caa aag ata tcc aag      2112
Ser Ala Glu Ser Phe Phe Val Arg Ala Asn Arg Gln Lys Ile Ser Lys
            690                 695                 700

cta agt cat cca tgt gca agc ttc gac aga gat gca gat gga ttt ttc      2160
Leu Ser His Pro Cys Ala Ser Phe Asp Arg Asp Ala Asp Gly Phe Phe
705                 710                 715                 720

gca ggt gag ggc tgt ggt gcc cta gtt ttc aag agg tta gaa gac tgt      2208
Ala Gly Glu Gly Cys Gly Ala Leu Val Phe Lys Arg Leu Glu Asp Cys
            725                 730                 735

gct cct cag gaa aaa att tat gct agt ata gac tct atc gca ata gat      2256
Ala Pro Gln Glu Lys Ile Tyr Ala Ser Ile Asp Ser Ile Ala Ile Asp
            740                 745                 750
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153

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aaa gag cct act agc tca gct gtg aaa gct gtc tac caa agt gat tcg     2304
Lys Glu Pro Thr Ser Ser Ala Val Lys Ala Val Tyr Gln Ser Asp Ser
        755                 760                 765

agt ctc tcc gat att gag ctg tta gaa atc agt gga gac tcc aaa cgg     2352
Ser Leu Ser Asp Ile Glu Leu Leu Glu Ile Ser Gly Asp Ser Lys Arg
        770                 775                 780

ttt gca gca ttc gaa ggc gct gtg gaa att caa tca agt gtg gaa gcc     2400
Phe Ala Ala Phe Glu Gly Ala Val Glu Ile Gln Ser Ser Val Glu Ala
785                 790                 795                 800

cag cta aaa gga ctt tcc aaa gtc ctt gaa cct gca aaa ggc caa ggc     2448
Gln Leu Lys Gly Leu Ser Lys Val Leu Glu Pro Ala Lys Gly Gln Gly
                805                 810                 815

gta gcg gtg gga agt act cga gca acc gtt ggg gat ata ggg tat gct     2496
Val Ala Val Gly Ser Thr Arg Ala Thr Val Gly Asp Ile Gly Tyr Ala
                820                 825                 830

aca gga gcg gca agc ctg att aaa act gca ctc tgc tta tat aat cgc     2544
Thr Gly Ala Ala Ser Leu Ile Lys Thr Ala Leu Cys Leu Tyr Asn Arg
                835                 840                 845

tac ctt ccg gca tta gca aac tgg agt ggc cca tgt gaa cag tcc gcc     2592
Tyr Leu Pro Ala Leu Ala Asn Trp Ser Gly Pro Cys Glu Gln Ser Ala
        850                 855                 860

tgg ggc tca aac atg ttc gtt tgc cat gaa aca cgg ccg tgg atg aaa     2640
Trp Gly Ser Asn Met Phe Val Cys His Glu Thr Arg Pro Trp Met Lys
865                 870                 875                 880

aac cag aat gaa aag aga tgt gcc ctc att tct gga aca gat cca tct     2688
Asn Gln Asn Glu Lys Arg Cys Ala Leu Ile Ser Gly Thr Asp Pro Ser
                885                 890                 895

cat aca tgc ttt tcc ctc gta cta tcg gat act ggg tgt tat gaa gag     2736
His Thr Cys Phe Ser Leu Val Leu Ser Asp Thr Gly Cys Tyr Glu Glu
                900                 905                 910

cac aat cga acg tgc ttt gat gtg caa gcg cca cag cta gtt ctg ata     2784
His Asn Arg Thr Cys Phe Asp Val Gln Ala Pro Gln Leu Val Leu Ile
                915                 920                 925

cac gga ttc gat gga aaa act att gtg cgg cga ctt gaa gga tat ctc     2832
His Gly Phe Asp Gly Lys Thr Ile Val Arg Arg Leu Glu Gly Tyr Leu
        930                 935                 940

ctt gaa ctt gtt gaa ggg cat gca agc cct tca gag tat ttc cac aaa     2880
Leu Glu Leu Val Glu Gly His Ala Ser Pro Ser Glu Tyr Phe His Lys
945                 950                 955                 960

ctg att gga caa agt cta ctt gag aac tcg aaa gaa agt aaa ctc aca     2928
Leu Ile Gly Gln Ser Leu Leu Glu Asn Ser Lys Glu Ser Lys Leu Thr
                965                 970                 975

ctt tcg ctt gtg tgc aat ccg aac cag ctc caa aag gag ctc atg ctt     2976
Leu Ser Leu Val Cys Asn Pro Asn Gln Leu Gln Lys Glu Leu Met Leu
                980                 985                 990

gct atc aaa gga gta caa cga agc  atg tta aca ggg aag  gat tgg gtc    3024
Ala Ile Lys Gly Val Gln Arg Ser  Met Leu Thr Gly Lys  Asp Trp Val
                995                 1000                1005

agt cca  tca gga agt tgt ttt  gcc cca aat ccg tta  tca agc gca       3069
Ser Pro  Ser Gly Ser Cys Phe  Ala Pro Asn Pro Leu  Ser Ser Ala
        1010                1015                1020
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154

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aaa gtg gca ttc atg tac gga   gaa ggc cga agc ccg   tac tgt ggt        3114
Lys Val Ala Phe Met Tyr Gly   Glu Gly Arg Ser Pro   Tyr Cys Gly
    1025                1030                1035

gta ggc ttg ggt cta cat cgt   ttg tgg ccc ggt ctc   cat gaa aat        3159
Val Gly Leu Gly Leu His Arg   Leu Trp Pro Gly Leu   His Glu Asn
    1040                1045                1050

gtg aac aat aag aca gtc gat   tta tgg acg gaa gga   gat ggt tgg        3204
Val Asn Asn Lys Thr Val Asp   Leu Trp Thr Glu Gly   Asp Gly Trp
    1055                1060                1065

tta tat cct cga acg ttg aca   cga gaa gag cat aca   aaa gcc atc        3249
Leu Tyr Pro Arg Thr Leu Thr   Arg Glu Glu His Thr   Lys Ala Ile
    1070                1075                1080

gaa tct ttc aac gca aat caa   att gaa atg ttt cgc   gct ggg att        3294
Glu Ser Phe Asn Ala Asn Gln   Ile Glu Met Phe Arg   Ala Gly Ile
    1085                1090                1095

ttc atc tca atg tgt cag aca   gac tat gtc atg aat   gtt ctc ggt        3339
Phe Ile Ser Met Cys Gln Thr   Asp Tyr Val Met Asn   Val Leu Gly
    1100                1105                1110

gtc cag cct aag gcc gga ttt   ggg ctg agc ttg gga   gaa att tca        3384
Val Gln Pro Lys Ala Gly Phe   Gly Leu Ser Leu Gly   Glu Ile Ser
    1115                1120                1125

atg ctc ttt gcg atg tca aag   gag aac tgc agg cag   tca cag gaa        3429
Met Leu Phe Ala Met Ser Lys   Glu Asn Cys Arg Gln   Ser Gln Glu
    1130                1135                1140

atg acc aat cgt ttg cgc ggt   tct cca gtg tgg tct   aac gag ctt        3474
Met Thr Asn Arg Leu Arg Gly   Ser Pro Val Trp Ser   Asn Glu Leu
    1145                1150                1155

gct atc aac ttc aat gca att   cgc aag tta tgg aaa   atc ccc cga        3519
Ala Ile Asn Phe Asn Ala Ile   Arg Lys Leu Trp Lys   Ile Pro Arg
    1160                1165                1170

gga gct ccc tta gaa tcc ttt   tgg caa gga tac ttg   gtt cac ggc        3564
Gly Ala Pro Leu Glu Ser Phe   Trp Gln Gly Tyr Leu   Val His Gly
    1175                1180                1185

aca aga gaa gaa gta gag cat   gct att ggt ctt tct   gag cct tat        3609
Thr Arg Glu Glu Val Glu His   Ala Ile Gly Leu Ser   Glu Pro Tyr
    1190                1195                1200

gta cgt ctg ctt att gtg aac   gat tca agg agt gcc   ttg att gct        3654
Val Arg Leu Leu Ile Val Asn   Asp Ser Arg Ser Ala   Leu Ile Ala
    1205                1210                1215

gga aaa cca gac gcc tgt cag   gca gta atc agt aga   cta aac tcc        3699
Gly Lys Pro Asp Ala Cys Gln   Ala Val Ile Ser Arg   Leu Asn Ser
    1220                1225                1230

aag ttc cct tct ctg ccg gta   aag caa gga atg att   ggt cat tgc        3744
Lys Phe Pro Ser Leu Pro Val   Lys Gln Gly Met Ile   Gly His Cys
    1235                1240                1245

cca gaa gtt cgt gcg ttc atc   aaa gat att ggg tac   atc cat gaa        3789
Pro Glu Val Arg Ala Phe Ile   Lys Asp Ile Gly Tyr   Ile His Glu
    1250                1255                1260

aca ctc cga att tcc aat gac   tat tcg gat tgt cag   ctt ttc tca        3834
Thr Leu Arg Ile Ser Asn Asp   Tyr Ser Asp Cys Gln   Leu Phe Ser
    1265                1270                1275
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155

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gcg gta acc aag ggc gca ctt  gac agc tcc aca atg  gaa atc aaa        3879
Ala Val Thr Lys Gly Ala Leu  Asp Ser Ser Thr Met  Glu Ile Lys
    1280             1285              1290

cac ttt gtg gga gag gtc tac  tcc cgg atc gca gac  ttt cct caa        3924
His Phe Val Gly Glu Val Tyr  Ser Arg Ile Ala Asp  Phe Pro Gln
    1295             1300              1305

atc gtc aac acg gtg cat tcg  gct ggt tat gac gta  ttt ctt gag        3969
Ile Val Asn Thr Val His Ser  Ala Gly Tyr Asp Val  Phe Leu Glu
    1310             1315              1320

ctt ggc tgt gat gct tct aga  tct gca gca gtt caa  aac att ctt        4014
Leu Gly Cys Asp Ala Ser Arg  Ser Ala Ala Val Gln  Asn Ile Leu
    1325             1330              1335

ggt ggt caa gga aag ttc ttg  tct aca gct att gac  aaa aaa gga        4059
Gly Gly Gln Gly Lys Phe Leu  Ser Thr Ala Ile Asp  Lys Lys Gly
    1340             1345              1350

cac tcc gcc tgg tca caa gta  ctt cgg gct acc gca  tca tta gct        4104
His Ser Ala Trp Ser Gln Val  Leu Arg Ala Thr Ala  Ser Leu Ala
    1355             1360              1365

gca cat cga gta ccg gga atc  tca att ttg gat ttg  ttt cac cca        4149
Ala His Arg Val Pro Gly Ile  Ser Ile Leu Asp Leu  Phe His Pro
    1370             1375              1380

aat ttc cga gaa atg tgc tgt  aca atg gca acc aca  cct aaa gtg        4194
Asn Phe Arg Glu Met Cys Cys  Thr Met Ala Thr Thr  Pro Lys Val
    1385             1390              1395

gaa gat aag ttc ctg cgc acg  att caa atc aat ggt  cgg ttt gaa        4239
Glu Asp Lys Phe Leu Arg Thr  Ile Gln Ile Asn Gly  Arg Phe Glu
    1400             1405              1410

aaa gaa atg att cac cta gaa  gat aca aca tta agt  tgc tta ccc        4284
Lys Glu Met Ile His Leu Glu  Asp Thr Thr Leu Ser  Cys Leu Pro
    1415             1420              1425

gct cca agt gaa gca aat atc  gca gct att caa tct  cgg tca att        4329
Ala Pro Ser Glu Ala Asn Ile  Ala Ala Ile Gln Ser  Arg Ser Ile
    1430             1435              1440

cga tct gct gcg gcg cgt tct  gga caa tcc cat gat  tgt gca tcc        4374
Arg Ser Ala Ala Ala Arg Ser  Gly Gln Ser His Asp  Cys Ala Ser
    1445             1450              1455

cat agc cat gaa gaa aat aag  gat tca tgc cct gaa  aag ctg aag        4419
His Ser His Glu Glu Asn Lys  Asp Ser Cys Pro Glu  Lys Leu Lys
    1460             1465              1470

ctt gat tct gtg tcc gtc gcc  ata aat ttc gac aat  gat gac cgc        4464
Leu Asp Ser Val Ser Val Ala  Ile Asn Phe Asp Asn  Asp Asp Arg
    1475             1480              1485

att cag ctt ggg cac gcg ggt  ttt cgg gag atg tac  aat aca aga        4509
Ile Gln Leu Gly His Ala Gly  Phe Arg Glu Met Tyr  Asn Thr Arg
    1490             1495              1500

tat agc ttg tac aca ggg gcg  atg gca aag gga att  gca tct gca        4554
Tyr Ser Leu Tyr Thr Gly Ala  Met Ala Lys Gly Ile  Ala Ser Ala
    1505             1510              1515

gat ctt gtc att gcc gct ggg  aaa gag ggc atc cta  gct tcc tat        4599
Asp Leu Val Ile Ala Ala Gly  Lys Glu Gly Ile Leu  Ala Ser Tyr
    1520             1525              1530
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gga gct gga gga cta cct ctt   gct act gtt cga aag   gga ata gac        4644
Gly Ala Gly Gly Leu Pro Leu   Ala Thr Val Arg Lys   Gly Ile Asp
    1535             1540                1545

aaa att caa caa gcc ttg cca   agt ggc cca tat gct   gta aat ctt        4689
Lys Ile Gln Gln Ala Leu Pro   Ser Gly Pro Tyr Ala   Val Asn Leu
    1550             1555                1560

att cac tct ccc ttt gac ggc   aac ttg gag cag gga   aac gtc gat        4734
Ile His Ser Pro Phe Asp Gly   Asn Leu Glu Gln Gly   Asn Val Asp
    1565             1570                1575   ,

ttg ttc ttg gaa aag aac gtc   cgc gtg gcg gaa tgt   tcc gcg ttt        4779
Leu Phe Leu Glu Lys Asn Val   Arg Val Ala Glu Cys   Ser Ala Phe
    1580             1585                1590

aca acg cta aca gtg cca gta   gta cac tat cgt gct   gca ggg ctt        4824
Thr Thr Leu Thr Val Pro Val   Val His Tyr Arg Ala   Ala Gly Leu
    1595             1600                1605

gtt cgg cgc caa gat gga agc   att ttg atc aag aac   cga atc att        4869
Val Arg Arg Gln Asp Gly Ser   Ile Leu Ile Lys Asn   Arg Ile Ile
    1610             1615                1620

gct aaa gta tct agg aca gaa   ctc gct gag atg ttc   ctt cgt ccg        4914
Ala Lys Val Ser Arg Thr Glu   Leu Ala Glu Met Phe   Leu Arg Pro
    1625             1630                1635

gca cct caa atc atc ctc gaa   aaa ctg gta gca gca   gaa atc att        4959
Ala Pro Gln Ile Ile Leu Glu   Lys Leu Val Ala Ala   Glu Ile Ile
    1640             1645                1650   .

tca tct gac caa gcg cgt atg   gca gcc aaa gtt ccc   atg gcg gac        5004
Ser Ser Asp Gln Ala Arg Met   Ala Ala Lys Val Pro   Met Ala Asp
    1655             1660                1665

gac atc gca gtc gaa gcc gac   tct ggt ggg cac acg   gat aat cgg        5049
Asp Ile Ala Val Glu Ala Asp   Ser Gly Gly His Thr   Asp Asn Arg
    1670             1675                1680

cct atg cac gtc att ttg ccc   ctg ata att caa ctc   cgc aat act        5094
Pro Met His Val Ile Leu Pro   Leu Ile Ile Gln Leu   Arg Asn Thr
    1685             1690                1695

ata ctt gca gag tat ggc tgt   gcc acg gct ttt cgt   acc cgt ata        5139
Ile Leu Ala Glu Tyr Gly Cys   Ala Thr Ala Phe Arg   Thr Arg Ile
    1700             1705                1710

ggc gct gga gga ggc att ggt   tgt cct tca gcg gcc   ctc gca gcc        5184
Gly Ala Gly Gly Gly Ile Gly   Cys Pro Ser Ala Ala   Leu Ala Ala
    1715             1720                1725

ttt gat atg ggt gcg agt ttt   gtc gtg act gga agc   ata aat caa        5229
Phe Asp Met Gly Ala Ser Phe   Val Val Thr Gly Ser   Ile Asn Gln
    1730             1735                1740

att tgc cgc gag gca ggg act   tgc gat act gtt cgg   gag cta ctt        5274
Ile Cys Arg Glu Ala Gly Thr   Cys Asp Thr Val Arg   Glu Leu Leu
    1745             1750                1755

gcc aac tca agc tac tcg gac   gtg acg atg gcg cca   gca gca gac        5319
Ala Asn Ser Ser Tyr Ser Asp   Val Thr Met Ala Pro   Ala Ala Asp
    1760             1765                1770

atg ttt gac caa ggt gtg aaa   ctc caa gtc tta aaa   cga gga acg        5364
Met Phe Asp Gln Gly Val Lys   Leu Gln Val Leu Lys   Arg Gly Thr
    1775             1780                1785
```

157

```
atg ttt  cca agc aga gca aat  aaa ctc cgg aag ctc  ttt gtg aac        5409
Met Phe  Pro Ser Arg Ala Asn  Lys Leu Arg Lys Leu  Phe Val Asn
    1790                 1795                 1800

tac gaa  tct cta gaa aca ctc  ccg tcg aaa gag ttg  aaa tac ctg        5454
Tyr Glu  Ser Leu Glu Thr Leu  Pro Ser Lys Glu Leu  Lys Tyr Leu
    1805                 1810                 1815

gaa aac  atc ata ttc aag caa  gca gta gac cag gtg  tgg gag gaa        5499
Glu Asn  Ile Ile Phe Lys Gln  Ala Val Asp Gln Val  Trp Glu Glu
    1820                 1825                 1830

aca aag  cgc ttt tac tgt gaa  aaa ctg aac aat cca  gat aaa att        5544
Thr Lys  Arg Phe Tyr Cys Glu  Lys Leu Asn Asn Pro  Asp Lys Ile
    1835                 1840                 1845

gca agg  gcc atg aaa gat cct  aaa ttg aag atg tcg  ctt tgc ttt        5589
Ala Arg  Ala Met Lys Asp Pro  Lys Leu Lys Met Ser  Leu Cys Phe
    1850                 1855                 1860

cgg tgg  tat ctc tcc aag agc  tct ggg tgg gcc aac  gca gga att        5634
Arg Trp  Tyr Leu Ser Lys Ser  Ser Gly Trp Ala Asn  Ala Gly Ile
    1865                 1870                 1875

aaa tct  cgt gca ctc gac tac  cag atc tgg tgt ggc  ccg gca atg        5679
Lys Ser  Arg Ala Leu Asp Tyr  Gln Ile Trp Cys Gly  Pro Ala Met
    1880                 1885                 1890

ggc tcg  ttc aac aat ttc gcc  agc ggc aca tcc ctc  gat tgg aaa        5724
Gly Ser  Phe Asn Asn Phe Ala  Ser Gly Thr Ser Leu  Asp Trp Lys
    1895                 1900                 1905

gtg act  ggg gtt ttc cct ggc  gtt gcg gaa gta aac  atg gcc att        5769
Val Thr  Gly Val Phe Pro Gly  Val Ala Glu Val Asn  Met Ala Ile
    1910                 1915                 1920

tta gat  ggc gcg cga gaa cta  gct gct aaa cga aat  taa                5808
Leu Asp  Gly Ala Arg Glu Leu  Ala Ala Lys Arg Asn
    1925                 1930                 1935


<210>  52
<211>  1935
<212>  PRT
<213>  Thraustochytrium sp.

<220>
<221>  misc_feature
<222>  (248)..(248)
<223>  The 'Xaa' at location 248 stands for Asp, Gly, Ala, or Val.

<400>  52

Met Gln Leu Pro Pro Ala His Ser Ala Asp Glu Asn Arg Ile Ala Val
1                 5                 10                15


Val Gly Met Ala Val Lys Tyr Ala Gly Cys Asp Asn Lys Glu Glu Phe
            20                25                30


Trp Lys Thr Leu Met Asn Gly Ser Ile Asn Thr Lys Ser Ile Ser Ala
        35                40                45


Ala Arg Leu Gly Ser Asn Lys Arg Asp Glu His Tyr Val Pro Glu Arg
    50                55                60
```

Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Arg Tyr Gly Cys Ile Gln
65   70   75   80

Gln Gly Thr Asp Asn Glu His Asp Leu Leu Leu Gly Leu Ala Gln Glu
                85   90   95

Ala Leu Ala Asp Ala Ala Gly Arg Met Glu Lys Gln Pro Ser Glu Ala
                100   105   110

Phe Asp Leu Glu Asn Thr Gly Ile Val Ser Gly Cys Leu Ser Phe Pro
            115   120   125

Met Asp Asn Leu Gln Gly Glu Leu Leu Asn Leu Tyr Gln Ser His Val
    130   135   140

Glu Lys Gln Leu Pro Pro Ser Ala Leu Val Glu Ala Val Lys Leu Trp
145   150   155   160

Ser Glu Arg Gln Lys Ser Thr Lys Ala His Ala Gly Asp Lys Arg Arg
                165   170   175

Phe Ile Asp Pro Ala Ser Phe Val Ala Asp Lys Leu Asn Leu Gly Pro
            180   185   190

Leu His Tyr Ala Ile Asp Ala Ala Cys Ala Ser Ala Leu Tyr Val Leu
            195   200   205

Lys Leu Ala Gln Asp His Leu Val Ser Gly Ala Val Asp Met Met Leu
    210   215   220

Cys Gly Ala Thr Cys Phe Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe
225   230   235   240

Ser Thr Phe Gln Ala Met Pro Xaa Gly Ala Asp Gly Val Ser Leu Pro
            245   250   255

Leu His Lys Thr Ser Ala Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile
            260   265   270

Met Val Leu Lys Arg Leu Lys Asp Ala Ile Arg Asp Gly Asn His Ile
    275   280   285

Tyr Gly Val Leu Leu Glu Ala Asn Leu Ser Asn Ala Gly Cys Gly Leu
    290   295   300

Pro Leu Ser Pro His Leu Pro Ser Glu Glu Ser Cys Ile Arg Asp Thr
305   310   315   320

Tyr Arg Arg Ala Gly Val Ala Ala Asp Gln Ser Ile Gln Tyr Ile Glu
            325   330   335

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Cys His Ala Thr Gly Thr Pro Arg Gly Asp Val Val Glu Ile Glu Ala
        340   345   350

Val Glu Arg Val Phe Lys Lys Asn Val Pro Arg Leu Gly Ser Thr Lys
        355   360   365

Gly Asn Phe Gly His Ser Leu Val Ala Ala Gly Phe Ala Gly Met Ala
    370   375   380

Lys Leu Leu Leu Ala Met Glu His Gly Val Ile Pro Pro Thr Pro Gly
385   390   395   400

Leu Asp Ala Ser Asn Gln Ala Ser Glu His Val Val Thr Lys Ala Ile
            405   410   415

Thr Trp Pro Glu Thr His Gly Ala Pro Lys Arg Ala Gly Leu Ser Ala
        420   425   430

Phe Gly Phe Gly Gly Thr Asn Ala His Ala Leu Phe Glu Glu Phe Asn
        435   440   445

Ala Glu Gly Ile Ser Tyr Arg Pro Gly Lys Pro Pro Val Glu Ser Asn
    450   455   460

Thr Arg Pro Ser Val Val Ile Thr Gly Met Asp Cys Thr Phe Gly Ser
465   470   475   480

Leu Glu Gly Ile Asp Ala Phe Glu Thr Ala Leu Tyr Glu Gly Arg Asp
            485   490   495

Ala Ala Arg Asp Leu Pro Ala Lys Arg Trp Arg Phe Leu Gly Glu Asp
            500   505   510

Leu Glu Phe Leu Arg Ala Ile Arg Leu Lys Glu Lys Pro Arg Gly Cys
        515   520   525

Phe Val Glu Ser Val Asp Val Asn Phe Arg Arg Leu Lys Thr Pro Leu
    530   535   540

Thr Pro Glu Asp Met Leu Arg Pro Gln Gln Leu Leu Ala Val Ser Thr
545   550   555   560

Met Asp Arg Ala Ile Ile Asp Ala Gly Leu Lys Lys Gly Gln His Val
            565   570   575

Ala Val Leu Val Gly Leu Gly Thr Asp Leu Glu Leu Tyr Arg His Arg
        580   585   590

Ala Arg Val Ala Leu Lys Glu Val Leu His Pro Ser Leu Lys Ser Asp
        595   600   605

160

```
Thr Ala Ile Leu Gln Lys Ile Met Gln Tyr Val Asn Asp Ala Gly Thr
    610             615             620

Ser Thr Ser Tyr Thr Ser Tyr Ile Gly Asn Leu Val Ala Thr Arg Ile
625             630             635             640

Ser Ser Gln Trp Gly Phe Thr Gly Pro Ser Phe Thr Val Thr Glu Gly
            645             650             655

Asn Asn Ser Val Tyr Arg Cys Ala Gln Leu Ala Lys Asp Met Leu Gln
        660             665             670

Val Asn Arg Val Asp Ala Val Val Ile Ala Gly Val Asp Leu Asn Gly
        675             680             685

Ser Ala Glu Ser Phe Phe Val Arg Ala Asn Arg Gln Lys Ile Ser Lys
    690             695             700

Leu Ser His Pro Cys Ala Ser Phe Asp Arg Asp Ala Asp Gly Phe Phe
705             710             715             720

Ala Gly Glu Gly Cys Gly Ala Leu Val Phe Lys Arg Leu Glu Asp Cys
            725             730             735

Ala Pro Gln Glu Lys Ile Tyr Ala Ser Ile Asp Ser Ile Ala Ile Asp
        740             745             750

Lys Glu Pro Thr Ser Ser Ala Val Lys Ala Val Tyr Gln Ser Asp Ser
        755             760             765

Ser Leu Ser Asp Ile Glu Leu Leu Glu Ile Ser Gly Asp Ser Lys Arg
    770             775             780

Phe Ala Ala Phe Glu Gly Ala Val Glu Ile Gln Ser Ser Val Glu Ala
785             790             795             800

Gln Leu Lys Gly Leu Ser Lys Val Leu Glu Pro Ala Lys Gly Gln Gly
            805             810             815

Val Ala Val Gly Ser Thr Arg Ala Thr Val Gly Asp Ile Gly Tyr Ala
        820             825             830

Thr Gly Ala Ala Ser Leu Ile Lys Thr Ala Leu Cys Leu Tyr Asn Arg
        835             840             845

Tyr Leu Pro Ala Leu Ala Asn Trp Ser Gly Pro Cys Glu Gln Ser Ala
    850             855             860

Trp Gly Ser Asn Met Phe Val Cys His Glu Thr Arg Pro Trp Met Lys
865             870             875             880
```

161

```
Asn Gln Asn Glu Lys Arg Cys Ala Leu Ile Ser Gly Thr Asp Pro Ser
            885                     890                 895


His Thr Cys Phe Ser Leu Val Leu Ser Asp Thr Gly Cys Tyr Glu Glu
            900                     905                 910


His Asn Arg Thr Cys Phe Asp Val Gln Ala Pro Gln Leu Val Leu Ile
            915                 920                     925


His Gly Phe Asp Gly Lys Thr Ile Val Arg Arg Leu Glu Gly Tyr Leu
    930                 935                     940


Leu Glu Leu Val Glu Gly His Ala Ser Pro Ser Glu Tyr Phe His Lys
945                 950                 955                     960


Leu Ile Gly Gln Ser Leu Leu Glu Asn Ser Lys Glu Ser Lys Leu Thr
                965                     970                 975


Leu Ser Leu Val Cys Asn Pro Asn Gln Leu Gln Lys Glu Leu Met Leu
            980                 985                     990


Ala Ile Lys Gly Val Gln Arg Ser  Met Leu Thr Gly Lys  Asp Trp Val
        995                 1000                 1005


Ser Pro  Ser Gly Ser Cys Phe  Ala Pro Asn Pro Leu  Ser Ser Ala
    1010                 1015                 1020


Lys Val  Ala Phe Met Tyr Gly  Glu Gly Arg Ser Pro  Tyr Cys Gly
    1025                 1030                 1035


Val Gly  Leu Gly Leu His Arg  Leu Trp Pro Gly Leu  His Glu Asn
    1040                 1045                 1050


Val Asn  Asn Lys Thr Val Asp  Leu Trp Thr Glu Gly  Asp Gly Trp
    1055                 1060                 1065


Leu Tyr  Pro Arg Thr Leu Thr  Arg Glu Glu His Thr  Lys Ala Ile
    1070                 1075                 1080


Glu Ser  Phe Asn Ala Asn Gln  Ile Glu Met Phe Arg  Ala Gly Ile
    1085                 1090                 1095


Phe Ile  Ser Met Cys Gln Thr  Asp Tyr Val Met Asn  Val Leu Gly
    1100                 1105                 1110


Val Gln  Pro Lys Ala Gly Phe  Gly Leu Ser Leu Gly  Glu Ile Ser
    1115                 1120                 1125


Met Leu  Phe Ala Met Ser Lys  Glu Asn Cys Arg Gln  Ser Gln Glu
    1130                 1135                 1140
```

```
Met Thr  Asn Arg Leu Arg Gly  Ser Pro Val Trp Ser  Asn Glu Leu
    1145              1150          1155

Ala Ile  Asn Phe Asn Ala Ile  Arg Lys Leu Trp Lys  Ile Pro Arg
    1160              1165          1170

Gly Ala  Pro Leu Glu Ser Phe  Trp Gln Gly Tyr Leu  Val His Gly
    1175              1180          1185

Thr Arg  Glu Glu Val Glu His  Ala Ile Gly Leu Ser  Glu Pro Tyr
    1190              1195          1200

Val Arg  Leu Leu Ile Val Asn  Asp Ser Arg Ser Ala  Leu Ile Ala
    1205              1210          1215

Gly Lys  Pro Asp Ala Cys Gln  Ala Val Ile Ser Arg  Leu Asn Ser
    1220              1225          1230

Lys Phe  Pro Ser Leu Pro Val  Lys Gln Gly Met Ile  Gly His Cys
    1235              1240          1245

Pro Glu  Val Arg Ala Phe Ile  Lys Asp Ile Gly Tyr  Ile His Glu
    1250              1255          1260

Thr Leu  Arg Ile Ser Asn Asp  Tyr Ser Asp Cys Gln  Leu Phe Ser
    1265                  1270          1275

Ala Val  Thr Lys Gly Ala Leu  Asp Ser Ser Thr Met  Glu Ile Lys
    1280              1285          1290

His Phe  Val Gly Glu Val Tyr  Ser Arg Ile Ala Asp  Phe Pro Gln
    1295              1300          1305

Ile Val  Asn Thr Val His Ser  Ala Gly Tyr Asp Val  Phe Leu Glu
    1310              1315          1320

Leu Gly  Cys Asp Ala Ser Arg  Ser Ala Ala Val Gln  Asn Ile Leu
    1325              1330          1335

Gly Gly  Gln Gly Lys Phe Leu  Ser Thr Ala Ile Asp  Lys Lys Gly
    1340              1345          1350

His Ser  Ala Trp Ser Gln Val  Leu Arg Ala Thr Ala  Ser Leu Ala
    1355              1360          1365

Ala His  Arg Val Pro Gly Ile  Ser Ile Leu Asp Leu  Phe His Pro
    1370              1375          1380

Asn Phe  Arg Glu Met Cys Cys  Thr Met Ala Thr Thr  Pro Lys Val
    1385              1390          1395
```

163

```
Glu Asp Lys Phe Leu Arg Thr  Ile Gln Ile Asn Gly  Arg Phe Glu
    1400                1405              1410

Lys Glu Met Ile His Leu Glu  Asp Thr Thr Leu Ser  Cys Leu Pro
    1415                1420              1425

Ala Pro Ser Glu Ala Asn Ile  Ala Ala Ile Gln Ser  Arg Ser Ile
    1430                1435              1440

Arg Ser Ala Ala Ala Arg Ser  Gly Gln Ser His Asp  Cys Ala Ser
    1445                1450              1455

His Ser His Glu Glu Asn Lys  Asp Ser Cys Pro Glu  Lys Leu Lys
    1460                1465              1470

Leu Asp Ser Val Ser Val Ala  Ile Asn Phe Asp Asn  Asp Asp Arg
    1475                1480              1485

Ile Gln Leu Gly His Ala Gly  Phe Arg Glu Met Tyr  Asn Thr Arg
    1490                1495              1500

Tyr Ser Leu Tyr Thr Gly Ala  Met Ala Lys Gly Ile  Ala Ser Ala
    1505                1510              1515

Asp Leu Val Ile Ala Ala Gly  Lys Glu Gly Ile Leu  Ala Ser Tyr
    1520                1525              1530

Gly Ala Gly Gly Leu Pro Leu  Ala Thr Val Arg Lys  Gly Ile Asp
    1535                1540              1545

Lys Ile Gln Gln Ala Leu Pro  Ser Gly Pro Tyr Ala  Val Asn Leu
    1550                1555              1560

Ile His Ser Pro Phe Asp Gly  Asn Leu Glu Gln Gly  Asn Val Asp
    1565                1570              1575

Leu Phe Leu Glu Lys Asn Val  Arg Val Ala Glu Cys  Ser Ala Phe
    1580                1585              1590

Thr Thr Leu Thr Val Pro Val  Val His Tyr Arg Ala  Ala Gly Leu
    1595                1600              1605

Val Arg Arg Gln Asp Gly Ser  Ile Leu Ile Lys Asn  Arg Ile Ile
    1610                1615              1620

Ala Lys Val Ser Arg Thr Glu  Leu Ala Glu Met Phe  Leu Arg Pro
    1625                1630              1635

Ala Pro Gln Ile Ile Leu Glu  Lys Leu Val Ala Ala  Glu Ile Ile
    1640                1645              1650
```

164

```
Ser Ser  Asp Gln Ala Arg Met  Ala Ala Lys Val Pro  Met Ala Asp
    1655             1660             1665

Asp Ile  Ala Val Glu Ala Asp  Ser Gly Gly His Thr  Asp Asn Arg
    1670             1675             1680

Pro Met  His Val Ile Leu Pro  Leu Ile Ile Gln Leu  Arg Asn Thr
    1685             1690             1695

Ile Leu  Ala Glu Tyr Gly Cys  Ala Thr Ala Phe Arg  Thr Arg Ile
    1700             1705             1710

Gly Ala  Gly Gly Gly Ile Gly  Cys Pro Ser Ala Ala  Leu Ala Ala
    1715             1720             1725

Phe Asp  Met Gly Ala Ser Phe  Val Val Thr Gly Ser  Ile Asn Gln
    1730             1735             1740

Ile Cys  Arg Glu Ala Gly Thr  Cys Asp Thr Val Arg  Glu Leu Leu
    1745             1750             1755

Ala Asn  Ser Ser Tyr Ser Asp  Val Thr Met Ala Pro  Ala Ala Asp
    1760             1765             1770

Met Phe  Asp Gln Gly Val Lys  Leu Gln Val Leu Lys  Arg Gly Thr
    1775             1780             1785

Met Phe  Pro Ser Arg Ala Asn  Lys Leu Arg Lys Leu  Phe Val Asn
    1790             1795             1800

Tyr Glu  Ser Leu Glu Thr Leu  Pro Ser Lys Glu Leu  Lys Tyr Leu
    1805             1810             1815

Glu Asn  Ile Ile Phe Lys Gln  Ala Val Asp Gln Val  Trp Glu Glu
    1820             1825             1830

Thr Lys  Arg Phe Tyr Cys Glu  Lys Leu Asn Asn Pro  Asp Lys Ile
    1835             1840             1845

Ala Arg  Ala Met Lys Asp Pro  Lys Leu Lys Met Ser  Leu Cys Phe
    1850             1855             1860

Arg Trp  Tyr Leu Ser Lys Ser  Ser Gly Trp Ala Asn  Ala Gly Ile
    1865             1870             1875

Lys Ser  Arg Ala Leu Asp Tyr  Gln Ile Trp Cys Gly  Pro Ala Met
    1880             1885             1890

Gly Ser  Phe Asn Asn Phe Ala  Ser Gly Thr Ser Leu  Asp Trp Lys
    1895             1900             1905
```

165

```
Val Thr  Gly Val Phe Pro Gly  Val Ala Glu Val Asn  Met Ala Ile
    1910            1915             1920


Leu Asp  Gly Ala Arg Glu Leu  Ala Ala Lys Arg Asn
    1925            1930             1935



<210>  53
<211>  1500
<212>  DNA
<213>  Thraustochytrium sp.


<220>
<221>  CDS
<222>  (1)..(1500)

<220>
<221>  misc_feature
<222>  (1)..(1500)
<223>  n = a c t or g

<400>  53
atg caa ctt cct cca gcg cat tct gcc gat gag aat cgc atc gcg gtc      48
Met Gln Leu Pro Pro Ala His Ser Ala Asp Glu Asn Arg Ile Ala Val
1                 5                10                15

gtg ggc atg gcc gtc aaa tat gcg ggc tgt gac aat aaa gaa gag ttt      96
Val Gly Met Ala Val Lys Tyr Ala Gly Cys Asp Asn Lys Glu Glu Phe
                20                25                30

tgg aag act ttg atg aat ggt agt atc aat acc aag tcg att tcg gca     144
Trp Lys Thr Leu Met Asn Gly Ser Ile Asn Thr Lys Ser Ile Ser Ala
            35                40                45

gca agg ttg ggc agc aat aag cgt gac gaa cac tat gtt cct gaa cga     192
Ala Arg Leu Gly Ser Asn Lys Arg Asp Glu His Tyr Val Pro Glu Arg
        50                55                60

tcg aaa tat gca gat acg ttc tgt aac gaa agg tac ggt tgt atc cag     240
Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Arg Tyr Gly Cys Ile Gln
65                70                75                80

caa ggt acg gat aat gag cat gac ctc ctc cta ggt ctt gct caa gaa     288
Gln Gly Thr Asp Asn Glu His Asp Leu Leu Leu Gly Leu Ala Gln Glu
                85                90                95

gct ctc gct gac gct gcc ggg cgg atg gag aaa caa cct tcg gag gcg     336
Ala Leu Ala Asp Ala Ala Gly Arg Met Glu Lys Gln Pro Ser Glu Ala
            100               105               110

ttc gat ctg gaa aat act ggc atc gtg agt ggg tgc tta tct ttt cca     384
Phe Asp Leu Glu Asn Thr Gly Ile Val Ser Gly Cys Leu Ser Phe Pro
            115               120               125

atg gat aac ctg caa gga gag ttg ttg aac ttg tat caa agc cat gtg     432
Met Asp Asn Leu Gln Gly Glu Leu Leu Asn Leu Tyr Gln Ser His Val
        130               135               140

gag aaa caa ctt cca cct agt gcc ttg gta gaa gcc gtg aag ctt tgg     480
Glu Lys Gln Leu Pro Pro Ser Ala Leu Val Glu Ala Val Lys Leu Trp
145               150               155               160

tct gag cga cag aaa tct acg aaa gca cat gca ggg gac aag cgc cgg     528
Ser Glu Arg Gln Lys Ser Thr Lys Ala His Ala Gly Asp Lys Arg Arg
                165               170               175
```

166

```
ttc att gac cca gct tct ttt gta gct gat aaa ctg aac cta ggc cca        576
Phe Ile Asp Pro Ala Ser Phe Val Ala Asp Lys Leu Asn Leu Gly Pro
            180                 185                 190

cta cat tat gcg atc gat gca gca tgc gct tct gca ttg tac gtg tta        624
Leu His Tyr Ala Ile Asp Ala Ala Cys Ala Ser Ala Leu Tyr Val Leu
            195                 200                 205

aaa tta gct caa gac cac ctt gtt tca ggt gcc gtt gat atg atg tta        672
Lys Leu Ala Gln Asp His Leu Val Ser Gly Ala Val Asp Met Met Leu
            210                 215                 220

tgt gga gcg acg tgc ttc cca gaa cca ttc ttc atc ttg tct ggg ttc        720
Cys Gly Ala Thr Cys Phe Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe
225                 230                 235                 240

tcg act ttt caa gcg atg cct gnt ggg gca gat gga gtc tca cta cct        768
Ser Thr Phe Gln Ala Met Pro Xaa Gly Ala Asp Gly Val Ser Leu Pro
            245                 250                 255

ctc cat aaa acg agt gct ggg ctc act cca ggt gaa ggg ggg tcc att        816
Leu His Lys Thr Ser Ala Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile
            260                 265                 270

atg gtg ctc aag cga ctg aaa gac gct atc aga gat gga aat cac att        864
Met Val Leu Lys Arg Leu Lys Asp Ala Ile Arg Asp Gly Asn His Ile
            275                 280                 285

tat ggt gtg ctc ctt gaa gca aat tta agt aac gca ggt tgt ggg ctt        912
Tyr Gly Val Leu Leu Glu Ala Asn Leu Ser Asn Ala Gly Cys Gly Leu
            290                 295                 300

cca ctc agc ccg cac tta ccg agc gaa gaa tca tgt att cgt gat acc        960
Pro Leu Ser Pro His Leu Pro Ser Glu Glu Ser Cys Ile Arg Asp Thr
305                 310                 315                 320

tac cgc cgt gct gga gtt gct gca gat caa agt att cag tat att gag       1008
Tyr Arg Arg Ala Gly Val Ala Ala Asp Gln Ser Ile Gln Tyr Ile Glu
            325                 330                 335

tgc cac gct acg gga acc cct cga ggg gat gtc gtg gaa att gag gcg       1056
Cys His Ala Thr Gly Thr Pro Arg Gly Asp Val Val Glu Ile Glu Ala
            340                 345                 350

gtt gaa aga gtt ttc aag aaa aac gtt cca cgc tta ggc tcg acg aaa       1104
Val Glu Arg Val Phe Lys Lys Asn Val Pro Arg Leu Gly Ser Thr Lys
            355                 360                 365

gga aat ttt ggt cac tcg tta gtt gcg gct ggt ttc gca ggt atg gca       1152
Gly Asn Phe Gly His Ser Leu Val Ala Ala Gly Phe Ala Gly Met Ala
            370                 375                 380

aag ctt ctt ctt gca atg gaa cat gga gtg att cct ccc aca cca ggt       1200
Lys Leu Leu Leu Ala Met Glu His Gly Val Ile Pro Pro Thr Pro Gly
385                 390                 395                 400

ctt gat gct tcg aac cag gca agt gag cac gtt gtg aca aag gct atc       1248
Leu Asp Ala Ser Asn Gln Ala Ser Glu His Val Val Thr Lys Ala Ile
            405                 410                 415

act tgg cct gag aca cat ggg gct cca aaa cga gct ggc ctt tca gca       1296
Thr Trp Pro Glu Thr His Gly Ala Pro Lys Arg Ala Gly Leu Ser Ala
            420                 425                 430

ttt gga ttt ggt ggg act aat gcg cat gca ctc ttc gaa gag ttt aat       1344
Phe Gly Phe Gly Gly Thr Asn Ala His Ala Leu Phe Glu Glu Phe Asn
            435                 440                 445
```

167

```
gcc gag ggc ata agt tat cgc cct gga aag cct cca gtc gaa tcg aat      1392
Ala Glu Gly Ile Ser Tyr Arg Pro Gly Lys Pro Pro Val Glu Ser Asn
    450             455             460

acc cgt cct tcc gtc gta ata act ggg atg gac tgt acc ttt ggg agc      1440
Thr Arg Pro Ser Val Val Ile Thr Gly Met Asp Cys Thr Phe Gly Ser
465             470             475             480

ctt gaa ggg att gat gcg ttc gag act gcc ctg tac gag ggg cgt gac      1488
Leu Glu Gly Ile Asp Ala Phe Glu Thr Ala Leu Tyr Glu Gly Arg Asp
            485             490             495

gca gct cgt gac                                                      1500
Ala Ala Arg Asp
        500
```

<210> 54
<211> 500
<212> PRT
<213> Thraustochytrium sp.

<220>
<221> misc_feature
<222> (248)..(248)
<223> The 'Xaa' at location 248 stands for Asp, Gly, Ala, or Val.

<400> 54

```
Met Gln Leu Pro Pro Ala His Ser Ala Asp Glu Asn Arg Ile Ala Val
1               5                   10                  15


Val Gly Met Ala Val Lys Tyr Ala Gly Cys Asp Asn Lys Glu Glu Phe
            20                  25                  30


Trp Lys Thr Leu Met Asn Gly Ser Ile Asn Thr Lys Ser Ile Ser Ala
        35                  40                  45


Ala Arg Leu Gly Ser Asn Lys Arg Asp Glu His Tyr Val Pro Glu Arg
    50                  55                  60


Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Arg Tyr Gly Cys Ile Gln
65                  70                  75                  80


Gln Gly Thr Asp Asn Glu His Asp Leu Leu Leu Gly Leu Ala Gln Glu
                85                  90                  95


Ala Leu Ala Asp Ala Ala Gly Arg Met Glu Lys Gln Pro Ser Glu Ala
                100             105             110


Phe Asp Leu Glu Asn Thr Gly Ile Val Ser Gly Cys Leu Ser Phe Pro
            115             120             125


Met Asp Asn Leu Gln Gly Glu Leu Leu Asn Leu Tyr Gln Ser His Val
        130             135             140


Glu Lys Gln Leu Pro Pro Ser Ala Leu Val Glu Ala Val Lys Leu Trp
145             150             155             160
```

168

```
Ser Glu Arg Gln Lys Ser Thr Lys Ala His Ala Gly Asp Lys Arg Arg
                165             170             175

Phe Ile Asp Pro Ala Ser Phe Val Ala Asp Lys Leu Asn Leu Gly Pro
                180             185             190

Leu His Tyr Ala Ile Asp Ala Ala Cys Ala Ser Ala Leu Tyr Val Leu
            195             200             205

Lys Leu Ala Gln Asp His Leu Val Ser Gly Ala Val Asp Met Met Leu
    210             215             220

Cys Gly Ala Thr Cys Phe Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe
225             230             235             240

Ser Thr Phe Gln Ala Met Pro Xaa Gly Ala Asp Gly Val Ser Leu Pro
                245             250             255

Leu His Lys Thr Ser Ala Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile
            260             265             270

Met Val Leu Lys Arg Leu Lys Asp Ala Ile Arg Asp Gly Asn His Ile
        275             280             285

Tyr Gly Val Leu Leu Glu Ala Asn Leu Ser Asn Ala Gly Cys Gly Leu
    290             295             300

Pro Leu Ser Pro His Leu Pro Ser Glu Glu Ser Cys Ile Arg Asp Thr
305             310             315             320

Tyr Arg Arg Ala Gly Val Ala Ala Asp Gln Ser Ile Gln Tyr Ile Glu
            325             330             335

Cys His Ala Thr Gly Thr Pro Arg Gly Asp Val Val Glu Ile Glu Ala
            340             345             350

Val Glu Arg Val Phe Lys Lys Asn Val Pro Arg Leu Gly Ser Thr Lys
        355             360             365

Gly Asn Phe Gly His Ser Leu Val Ala Ala Gly Phe Ala Gly Met Ala
    370             375             380

Lys Leu Leu Leu Ala Met Glu His Gly Val Ile Pro Pro Thr Pro Gly
385             390             395             400

Leu Asp Ala Ser Asn Gln Ala Ser Glu His Val Val Thr Lys Ala Ile
            405             410             415

Thr Trp Pro Glu Thr His Gly Ala Pro Lys Arg Ala Gly Leu Ser Ala
            420             425             430
```

169

```
Phe Gly Phe Gly Gly Thr Asn Ala His Ala Leu Phe Glu Glu Phe Asn
        435             440             445

Ala Glu Gly Ile Ser Tyr Arg Pro Gly Lys Pro Pro Val Glu Ser Asn
        450             455             460

Thr Arg Pro Ser Val Val Ile Thr Gly Met Asp Cys Thr Phe Gly Ser
465             470             475             480

Leu Glu Gly Ile Asp Ala Phe Glu Thr Ala Leu Tyr Glu Gly Arg Asp
                485             490             495

Ala Ala Arg Asp
            500


<210>   55
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<212>   DNA
<213>   Thraustochytrium sp.


<220>
<221>   CDS
<222>   (1)..(1500)

<400>   55
tta ccc gcc aaa cgt tgg agg ttc cta ggt gag gac ttg gag ttt ctc        48
Leu Pro Ala Lys Arg Trp Arg Phe Leu Gly Glu Asp Leu Glu Phe Leu
1               5                   10                  15

cga gcc atc agg ctc aag gaa aag cct agg ggt tgt ttt gtg gag agt        96
Arg Ala Ile Arg Leu Lys Glu Lys Pro Arg Gly Cys Phe Val Glu Ser
                20                  25                  30

gtt gac gtt aac ttt aga cgg ctg aaa acg ccc ttg aca cca gaa gat       144
Val Asp Val Asn Phe Arg Arg Leu Lys Thr Pro Leu Thr Pro Glu Asp
            35                  40                  45

atg ttg cgg ccc caa caa ctc ttg gcg gtt tct acg atg gac cga gca       192
Met Leu Arg Pro Gln Gln Leu Leu Ala Val Ser Thr Met Asp Arg Ala
        50                  55                  60

att atc gat gca ggt cta aag aag ggc caa cat gta gca gtt ctt gtt       240
Ile Ile Asp Ala Gly Leu Lys Lys Gly Gln His Val Ala Val Leu Val
65                  70                  75                  80

ggc cta gga act gac ctg gaa ctt tac cgt cat cga gca aga gtc gcg       288
Gly Leu Gly Thr Asp Leu Glu Leu Tyr Arg His Arg Ala Arg Val Ala
                85                  90                  95

ctt aaa gag gtt ttg cac ccg agc tta aag tca gac act gca att ctc       336
Leu Lys Glu Val Leu His Pro Ser Leu Lys Ser Asp Thr Ala Ile Leu
                100                 105                 110

cag aaa ata atg caa tat gtg aat gat gca gga act tcg act tca tac       384
Gln Lys Ile Met Gln Tyr Val Asn Asp Ala Gly Thr Ser Thr Ser Tyr
        115                 120                 125

aca tct tac att gga aac ctc gtt gcc acg cgt att tcg tct cag tgg       432
Thr Ser Tyr Ile Gly Asn Leu Val Ala Thr Arg Ile Ser Ser Gln Trp
        130                 135                 140

gga ttc aca ggg ccg tcc ttt act gtc aca gaa gga aat aat tcc gtg       480
```

170

```
Gly Phe Thr Gly Pro Ser Phe Thr Val Thr Glu Gly Asn Asn Ser Val
145             150             155             160

tac aga tgt gca caa cta gcc aaa gat atg ctt cag gtt aac cga gtt        528
Tyr Arg Cys Ala Gln Leu Ala Lys Asp Met Leu Gln Val Asn Arg Val
                165             170             175

gat gct gtc gtc atc gca ggc gtt gat ctc aac gga agc gcc gaa agt        576
Asp Ala Val Val Ile Ala Gly Val Asp Leu Asn Gly Ser Ala Glu Ser
                180             185             190

ttt ttt gtc cga gca aat cgt caa aag ata tcc aag cta agt cat cca        624
Phe Phe Val Arg Ala Asn Arg Gln Lys Ile Ser Lys Leu Ser His Pro
            195             200             205

tgt gca agc ttc gac aga gat gca gat gga ttt ttc gca ggt gag ggc        672
Cys Ala Ser Phe Asp Arg Asp Ala Asp Gly Phe Phe Ala Gly Glu Gly
    210             215             220

tgt ggt gcc cta gtt ttc aag agg tta gaa gac tgt gct cct cag gaa        720
Cys Gly Ala Leu Val Phe Lys Arg Leu Glu Asp Cys Ala Pro Gln Glu
225             230             235             240

aaa att tat gct agt ata gac tct atc gca ata gat aaa gag cct act        768
Lys Ile Tyr Ala Ser Ile Asp Ser Ile Ala Ile Asp Lys Glu Pro Thr
                245             250             255

agc tca gct gtg aaa gct gtc tac caa agt gat tcg agt ctc tcc gat        816
Ser Ser Ala Val Lys Ala Val Tyr Gln Ser Asp Ser Ser Leu Ser Asp
                260             265             270

att gag ctg tta gaa atc agt gga gac tcc aaa cgg ttt gca gca ttc        864
Ile Glu Leu Leu Glu Ile Ser Gly Asp Ser Lys Arg Phe Ala Ala Phe
            275             280             285

gaa ggc gct gtg gaa att caa tca agt gtg gaa gcc cag cta aaa gga        912
Glu Gly Ala Val Glu Ile Gln Ser Ser Val Glu Ala Gln Leu Lys Gly
    290             295             300

ctt tcc aaa gtc ctt gaa cct gca aaa ggc caa ggc gta gcg gtg gga        960
Leu Ser Lys Val Leu Glu Pro Ala Lys Gly Gln Gly Val Ala Val Gly
305             310             315             320

agt act cga gca acc gtt ggg gat ata ggg tat gct aca gga gcg gca        1008
Ser Thr Arg Ala Thr Val Gly Asp Ile Gly Tyr Ala Thr Gly Ala Ala
                325             330             335

agc ctg att aaa act gca ctc tgc tta tat aat cgc tac ctt ccg gca        1056
Ser Leu Ile Lys Thr Ala Leu Cys Leu Tyr Asn Arg Tyr Leu Pro Ala
            340             345             350

tta gca aac tgg agt ggc cca tgt gaa cag tcc gcc tgg ggc tca aac        1104
Leu Ala Asn Trp Ser Gly Pro Cys Glu Gln Ser Ala Trp Gly Ser Asn
            355             360             365

atg ttc gtt tgc cat gaa aca cgg ccg tgg atg aaa aac cag aat gaa        1152
Met Phe Val Cys His Glu Thr Arg Pro Trp Met Lys Asn Gln Asn Glu
    370             375             380

aag aga tgt gcc ctc att tct gga aca gat cca tct cat aca tgc ttt        1200
Lys Arg Cys Ala Leu Ile Ser Gly Thr Asp Pro Ser His Thr Cys Phe
385             390             395             400

tcc ctc gta cta tcg gat act ggg tgt tat gaa gag cac aat cga acg        1248
Ser Leu Val Leu Ser Asp Thr Gly Cys Tyr Glu Glu His Asn Arg Thr
            405             410             415

tgc ttt gat gtg caa gcg cca cag cta gtt ctg ata cac gga ttc gat        1296
```

171

```
Cys Phe Asp Val Gln Ala Pro Gln Leu Val Leu Ile His Gly Phe Asp
            420             425             430

gga aaa act att gtg cgg cga ctt gaa gga tat ctc ctt gaa ctt gtt      1344
Gly Lys Thr Ile Val Arg Arg Leu Glu Gly Tyr Leu Leu Glu Leu Val
            435             440             445

gaa ggg cat gca agc cct tca gag tat ttc cac aaa ctg att gga caa      1392
Glu Gly His Ala Ser Pro Ser Glu Tyr Phe His Lys Leu Ile Gly Gln
        450             455             460

agt cta ctt gag aac tcg aaa gaa agt aaa ctc aca ctt tcg ctt gtg      1440
Ser Leu Leu Glu Asn Ser Lys Glu Ser Lys Leu Thr Leu Ser Leu Val
465             470             475             480

tgc aat ccg aac cag ctc caa aag gag ctc atg ctt gct atc aaa gga      1488
Cys Asn Pro Asn Gln Leu Gln Lys Glu Leu Met Leu Ala Ile Lys Gly
                485             490             495

gta caa cga agc                                                      1500
Val Gln Arg Ser
            500


<210>  56
<211>  500
<212>  PRT
<213>  Thraustochytrium sp.

<400>  56

Leu Pro Ala Lys Arg Trp Arg Phe Leu Gly Glu Asp Leu Glu Phe Leu
1             5               10              15


Arg Ala Ile Arg Leu Lys Glu Lys Pro Arg Gly Cys Phe Val Glu Ser
            20              25              30


Val Asp Val Asn Phe Arg Arg Leu Lys Thr Pro Leu Thr Pro Glu Asp
            35              40              45


Met Leu Arg Pro Gln Gln Leu Leu Ala Val Ser Thr Met Asp Arg Ala
    50              55              60


Ile Ile Asp Ala Gly Leu Lys Lys Gly Gln His Val Ala Val Leu Val
65              70              75              80


Gly Leu Gly Thr Asp Leu Glu Leu Tyr Arg His Arg Ala Arg Val Ala
            85              90              95


Leu Lys Glu Val Leu His Pro Ser Leu Lys Ser Asp Thr Ala Ile Leu
            100             105             110


Gln Lys Ile Met Gln Tyr Val Asn Asp Ala Gly Thr Ser Thr Ser Tyr
            115             120             125


Thr Ser Tyr Ile Gly Asn Leu Val Ala Thr Arg Ile Ser Ser Gln Trp
    130             135             140


Gly Phe Thr Gly Pro Ser Phe Thr Val Thr Glu Gly Asn Asn Ser Val
```

172

Tyr Arg Cys Ala Gln Leu Ala Lys Asp Met Leu Gln Val Asn Arg Val
            165   170   175

Asp Ala Val Val Ile Ala Gly Val Asp Leu Asn Gly Ser Ala Glu Ser
            180   185   190

Phe Phe Val Arg Ala Asn Arg Gln Lys Ile Ser Lys Leu Ser His Pro
        195   200   205

Cys Ala Ser Phe Asp Arg Asp Ala Asp Gly Phe Phe Ala Gly Glu Gly
    210   215   220

Cys Gly Ala Leu Val Phe Lys Arg Leu Glu Asp Cys Ala Pro Gln Glu
225   230   235   240

Lys Ile Tyr Ala Ser Ile Asp Ser Ile Ala Ile Asp Lys Glu Pro Thr
            245   250   255

Ser Ser Ala Val Lys Ala Val Tyr Gln Ser Asp Ser Ser Leu Ser Asp
            260   265   270

Ile Glu Leu Leu Glu Ile Ser Gly Asp Ser Lys Arg Phe Ala Ala Phe
        275   280   285

Glu Gly Ala Val Glu Ile Gln Ser Ser Val Glu Ala Gln Leu Lys Gly
    290   295   300

Leu Ser Lys Val Leu Glu Pro Ala Lys Gly Gln Gly Val Ala Val Gly
305   310   315   320

Ser Thr Arg Ala Thr Val Gly Asp Ile Gly Tyr Ala Thr Gly Ala Ala
            325   330   335

Ser Leu Ile Lys Thr Ala Leu Cys Leu Tyr Asn Arg Tyr Leu Pro Ala
            340   345   350

Leu Ala Asn Trp Ser Gly Pro Cys Glu Gln Ser Ala Trp Gly Ser Asn
            355   360   365

Met Phe Val Cys His Glu Thr Arg Pro Trp Met Lys Asn Gln Asn Glu
    370   375   380

Lys Arg Cys Ala Leu Ile Ser Gly Thr Asp Pro Ser His Thr Cys Phe
385   390   395   400

Ser Leu Val Leu Ser Asp Thr Gly Cys Tyr Glu Glu His Asn Arg Thr
            405   410   415

Cys Phe Asp Val Gln Ala Pro Gln Leu Val Leu Ile His Gly Phe Asp

173

```
                  420                    425                    430


Gly Lys Thr Ile Val Arg Arg Leu Glu Gly Tyr Leu Leu Glu Leu Val
        435                    440                    445


Glu Gly His Ala Ser Pro Ser Glu Tyr Phe His Lys Leu Ile Gly Gln
    450                    455                    460


Ser Leu Leu Glu Asn Ser Lys Glu Ser Lys Leu Thr Leu Ser Leu Val
465                    470                    475                    480


Cys Asn Pro Asn Gln Leu Gln Lys Glu Leu Met Leu Ala Ile Lys Gly
                485                    490                    495


Val Gln Arg Ser
            500


<210>  57
<211>  1500
<212>  DNA
<213>  Thraustochytrium sp.


<220>
<221>  CDS
<222>  (1)..(1500)


<400>  57
atg tta aca ggg aag gat tgg gtc agt cca tca gga agt tgt ttt gcc      48
Met Leu Thr Gly Lys Asp Trp Val Ser Pro Ser Gly Ser Cys Phe Ala
1               5                   10                  15

cca aat ccg tta tca agc gca aaa gtg gca ttc atg tac gga gaa ggc      96
Pro Asn Pro Leu Ser Ser Ala Lys Val Ala Phe Met Tyr Gly Glu Gly
            20                  25                  30

cga agc ccg tac tgt ggt gta ggc ttg ggt cta cat cgt ttg tgg ccc     144
Arg Ser Pro Tyr Cys Gly Val Gly Leu Gly Leu His Arg Leu Trp Pro
        35                  40                  45

ggt ctc cat gaa aat gtg aac aat aag aca gtc gat tta tgg acg gaa     192
Gly Leu His Glu Asn Val Asn Asn Lys Thr Val Asp Leu Trp Thr Glu
    50                  55                  60

gga gat ggt tgg tta tat cct cga acg ttg aca cga gaa gag cat aca     240
Gly Asp Gly Trp Leu Tyr Pro Arg Thr Leu Thr Arg Glu Glu His Thr
65                  70                  75                  80

aaa gcc atc gaa tct ttc aac gca aat caa att gaa atg ttt cgc gct     288
Lys Ala Ile Glu Ser Phe Asn Ala Asn Gln Ile Glu Met Phe Arg Ala
                85                  90                  95

ggg att ttc atc tca atg tgt cag aca gac tat gtc atg aat gtt ctc     336
Gly Ile Phe Ile Ser Met Cys Gln Thr Asp Tyr Val Met Asn Val Leu
            100                 105                 110

ggt gtc cag cct aag gcc gga ttt ggg ctg agc ttg gga gaa att tca     384
Gly Val Gln Pro Lys Ala Gly Phe Gly Leu Ser Leu Gly Glu Ile Ser
        115                 120                 125

atg ctc ttt gcg atg tca aag gag aac tgc agg cag tca cag gaa atg     432
Met Leu Phe Ala Met Ser Lys Glu Asn Cys Arg Gln Ser Gln Glu Met
```

174

```
acc aat cgt ttg cgc ggt tct cca gtg tgg tct aac gag ctt gct atc        480
Thr Asn Arg Leu Arg Gly Ser Pro Val Trp Ser Asn Glu Leu Ala Ile
145                     150                 155                 160

aac ttc aat gca att cgc aag tta tgg aaa atc ccc cga gga gct ccc        528
Asn Phe Asn Ala Ile Arg Lys Leu Trp Lys Ile Pro Arg Gly Ala Pro
                165                 170                 175

tta gaa tcc ttt tgg caa gga tac ttg gtt cac ggc aca aga gaa gaa        576
Leu Glu Ser Phe Trp Gln Gly Tyr Leu Val His Gly Thr Arg Glu Glu
                180                 185                 190

gta gag cat gct att ggt ctt tct gag cct tat gta cgt ctg ctt att        624
Val Glu His Ala Ile Gly Leu Ser Glu Pro Tyr Val Arg Leu Leu Ile
                195                 200                 205

gtg aac gat tca agg agt gcc ttg att gct gga aaa cca gac gcc tgt        672
Val Asn Asp Ser Arg Ser Ala Leu Ile Ala Gly Lys Pro Asp Ala Cys
        210                 215                 220

cag gca gta atc agt aga cta aac tcc aag ttc cct tct ctg ccg gta        720
Gln Ala Val Ile Ser Arg Leu Asn Ser Lys Phe Pro Ser Leu Pro Val
225                     230                 235                 240

aag caa gga atg att ggt cat tgc cca gaa gtt cgt gcg ttc atc aaa        768
Lys Gln Gly Met Ile Gly His Cys Pro Glu Val Arg Ala Phe Ile Lys
                245                 250                 255

gat att ggg tac atc cat gaa aca ctc cga att tcc aat gac tat tcg        816
Asp Ile Gly Tyr Ile His Glu Thr Leu Arg Ile Ser Asn Asp Tyr Ser
                260                 265                 270

gat tgt cag ctt ttc tca gcg gta acc aag ggc gca ctt gac agc tcc        864
Asp Cys Gln Leu Phe Ser Ala Val Thr Lys Gly Ala Leu Asp Ser Ser
                275                 280                 285

aca atg gaa atc aaa cac ttt gtg gga gag gtc tac tcc cgg atc gca        912
Thr Met Glu Ile Lys His Phe Val Gly Glu Val Tyr Ser Arg Ile Ala
        290                 295                 300

gac ttt cct caa atc gtc aac acg gtg cat tcg gct ggt tat gac gta        960
Asp Phe Pro Gln Ile Val Asn Thr Val His Ser Ala Gly Tyr Asp Val
305                     310                 315                 320

ttt ctt gag ctt ggc tgt gat gct tct aga tct gca gca gtt caa aac       1008
Phe Leu Glu Leu Gly Cys Asp Ala Ser Arg Ser Ala Ala Val Gln Asn
                325                 330                 335

att ctt ggt ggt caa gga aag ttc ttg tct aca gct att gac aaa aaa       1056
Ile Leu Gly Gly Gln Gly Lys Phe Leu Ser Thr Ala Ile Asp Lys Lys
                340                 345                 350

gga cac tcc gcc tgg tca caa gta ctt cgg gct acc gca tca tta gct       1104
Gly His Ser Ala Trp Ser Gln Val Leu Arg Ala Thr Ala Ser Leu Ala
                355                 360                 365

gca cat cga gta ccg gga atc tca att ttg gat ttg ttt cac cca aat       1152
Ala His Arg Val Pro Gly Ile Ser Ile Leu Asp Leu Phe His Pro Asn
        370                 375                 380

ttc cga gaa atg tgc tgt aca atg gca acc aca cct aaa gtg gaa gat       1200
Phe Arg Glu Met Cys Cys Thr Met Ala Thr Thr Pro Lys Val Glu Asp
385                     390                 395                 400

aag ttc ctg cgc acg att caa atc aat ggt cgg ttt gaa aaa gaa atg      1248
Lys Phe Leu Arg Thr Ile Gln Ile Asn Gly Arg Phe Glu Lys Glu Met
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att cac cta gaa gat aca aca tta agt tgc tta ccc gct cca agt gaa    1296
Ile His Leu Glu Asp Thr Thr Leu Ser Cys Leu Pro Ala Pro Ser Glu
            420             425             430

gca aat atc gca gct att caa tct cgg tca att cga tct gct gcg gcg    1344
Ala Asn Ile Ala Ala Ile Gln Ser Arg Ser Ile Arg Ser Ala Ala Ala
            435             440             445

cgt tct gga caa tcc cat gat tgt gca tcc cat agc cat gaa gaa aat    1392
Arg Ser Gly Gln Ser His Asp Cys Ala Ser His Ser His Glu Glu Asn
    450             455             460

aag gat tca tgc cct gaa aag ctg aag ctt gat tct gtg tcc gtc gcc    1440
Lys Asp Ser Cys Pro Glu Lys Leu Lys Leu Asp Ser Val Ser Val Ala
465             470             475             480

ata aat ttc gac aat gat gac cgc att cag ctt ggg cac gcg ggt ttt    1488
Ile Asn Phe Asp Asn Asp Asp Arg Ile Gln Leu Gly His Ala Gly Phe
            485             490             495

cgg gag atg tac                                                    1500
Arg Glu Met Tyr
            500
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<210> 58
<211> 500
<212> PRT
<213> Thraustochytrium sp.

<400> 58

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Met Leu Thr Gly Lys Asp Trp Val Ser Pro Ser Gly Ser Cys Phe Ala
1               5               10              15

Pro Asn Pro Leu Ser Ser Ala Lys Val Ala Phe Met Tyr Gly Glu Gly
            20              25              30

Arg Ser Pro Tyr Cys Gly Val Gly Leu Gly Leu His Arg Leu Trp Pro
        35              40              45

Gly Leu His Glu Asn Val Asn Asn Lys Thr Val Asp Leu Trp Thr Glu
    50              55              60

Gly Asp Gly Trp Leu Tyr Pro Arg Thr Leu Thr Arg Glu Glu His Thr
65              70              75              80

Lys Ala Ile Glu Ser Phe Asn Ala Asn Gln Ile Glu Met Phe Arg Ala
                85              90              95

Gly Ile Phe Ile Ser Met Cys Gln Thr Asp Tyr Val Met Asn Val Leu
            100             105             110

Gly Val Gln Pro Lys Ala Gly Phe Gly Leu Ser Leu Gly Glu Ile Ser
        115             120             125

Met Leu Phe Ala Met Ser Lys Glu Asn Cys Arg Gln Ser Gln Glu Met
    130             135             140
```

```
Thr Asn Arg Leu Arg Gly Ser Pro Val Trp Ser Asn Glu Leu Ala Ile
145                 150             155                 160


Asn Phe Asn Ala Ile Arg Lys Leu Trp Lys Ile Pro Arg Gly Ala Pro
                165             170                 175


Leu Glu Ser Phe Trp Gln Gly Tyr Leu Val His Gly Thr Arg Glu Glu
            180             185             190


Val Glu His Ala Ile Gly Leu Ser Glu Pro Tyr Val Arg Leu Leu Ile
            195             200             205


Val Asn Asp Ser Arg Ser Ala Leu Ile Ala Gly Lys Pro Asp Ala Cys
    210             215             220


Gln Ala Val Ile Ser Arg Leu Asn Ser Lys Phe Pro Ser Leu Pro Val
225             230             235                 240


Lys Gln Gly Met Ile Gly His Cys Pro Glu Val Arg Ala Phe Ile Lys
            245             250             255


Asp Ile Gly Tyr Ile His Glu Thr Leu Arg Ile Ser Asn Asp Tyr Ser
            260             265             270


Asp Cys Gln Leu Phe Ser Ala Val Thr Lys Gly Ala Leu Asp Ser Ser
    275             280             285


Thr Met Glu Ile Lys His Phe Val Gly Glu Val Tyr Ser Arg Ile Ala
    290             295             300


Asp Phe Pro Gln Ile Val Asn Thr Val His Ser Ala Gly Tyr Asp Val
305             310             315                 320


Phe Leu Glu Leu Gly Cys Asp Ala Ser Arg Ser Ala Ala Val Gln Asn
            325             330                 335


Ile Leu Gly Gly Gln Gly Lys Phe Leu Ser Thr Ala Ile Asp Lys Lys
            340             345             350


Gly His Ser Ala Trp Ser Gln Val Leu Arg Ala Thr Ala Ser Leu Ala
            355             360             365


Ala His Arg Val Pro Gly Ile Ser Ile Leu Asp Leu Phe His Pro Asn
    370             375             380


Phe Arg Glu Met Cys Cys Thr Met Ala Thr Thr Pro Lys Val Glu Asp
385             390             395                 400


Lys Phe Leu Arg Thr Ile Gln Ile Asn Gly Arg Phe Glu Lys Glu Met
            405             410             415
```

177

```
Ile His Leu Glu Asp Thr Thr Leu Ser Cys Leu Pro Ala Pro Ser Glu
            420                 425             430

Ala Asn Ile Ala Ala Ile Gln Ser Arg Ser Ile Arg Ser Ala Ala Ala
            435                 440             445

Arg Ser Gly Gln Ser His Asp Cys Ala Ser His Ser His Glu Glu Asn
        450                 455                 460

Lys Asp Ser Cys Pro Glu Lys Leu Lys Leu Asp Ser Val Ser Val Ala
465                 470                 475                 480

Ile Asn Phe Asp Asn Asp Asp Arg Ile Gln Leu Gly His Ala Gly Phe
            485                 490                 495

Arg Glu Met Tyr
            500


<210>  59
<211>  1305
<212>  DNA
<213>  Thraustochytrium sp.


<220>
<221>  CDS
<222>  (1)..(1305)

<400>  59
aat aca aga tat agc ttg tac aca ggg gcg atg gca aag gga att gca     48
Asn Thr Arg Tyr Ser Leu Tyr Thr Gly Ala Met Ala Lys Gly Ile Ala
1               5                   10                  15

tct gca gat ctt gtc att gcc gct ggg aaa gag ggc atc cta gct tcc     96
Ser Ala Asp Leu Val Ile Ala Ala Gly Lys Glu Gly Ile Leu Ala Ser
            20                  25                  30

tat gga gct gga gga cta cct ctt gct act gtt cga aag gga ata gac    144
Tyr Gly Ala Gly Gly Leu Pro Leu Ala Thr Val Arg Lys Gly Ile Asp
        35                  40                  45

aaa att caa caa gcc ttg cca agt ggc cca tat gct gta aat ctt att    192
Lys Ile Gln Gln Ala Leu Pro Ser Gly Pro Tyr Ala Val Asn Leu Ile
    50                  55                  60

cac tct ccc ttt gac ggc aac ttg gag cag gga aac gtc gat ttg ttc    240
His Ser Pro Phe Asp Gly Asn Leu Glu Gln Gly Asn Val Asp Leu Phe
65                  70                  75                  80

ttg gaa aag aac gtc cgc gtg gcg gaa tgt tcc gcg ttt aca acg cta    288
Leu Glu Lys Asn Val Arg Val Ala Glu Cys Ser Ala Phe Thr Thr Leu
            85                  90                  95

aca gtg cca gta gta cac tat cgt gct gca ggg ctt gtt cgg cgc caa    336
Thr Val Pro Val Val His Tyr Arg Ala Ala Gly Leu Val Arg Arg Gln
            100                 105                 110

gat gga agc att ttg atc aag aac cga atc att gct aaa gta tct agg    384
Asp Gly Ser Ile Leu Ile Lys Asn Arg Ile Ile Ala Lys Val Ser Arg
        115                 120                 125

aca gaa ctc gct gag atg ttc ctt cgt ccg gca cct caa atc atc ctc    432
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178

```
    Thr Glu Leu Ala Glu Met Phe Leu Arg Pro Ala Pro Gln Ile Ile Leu
        130             135                 140

gaa aaa ctg gta gca gca gaa atc att tca tct gac caa gcg cgt atg          480
Glu Lys Leu Val Ala Ala Glu Ile Ile Ser Ser Asp Gln Ala Arg Met
145             150                 155                 160

gca gcc aaa gtt ccc atg gcg gac gac atc gca gtc gaa gcc gac tct          528
Ala Ala Lys Val Pro Met Ala Asp Asp Ile Ala Val Glu Ala Asp Ser
                165                 170                 175

ggt ggg cac acg gat aat cgg cct atg cac gtc att ttg ccc ctg ata          576
Gly Gly His Thr Asp Asn Arg Pro Met His Val Ile Leu Pro Leu Ile
            180                 185                 190

att caa ctc cgc aat act ata ctt gca gag tat ggc tgt gcc acg gct          624
Ile Gln Leu Arg Asn Thr Ile Leu Ala Glu Tyr Gly Cys Ala Thr Ala
            195                 200                 205

ttt cgt acc cgt ata ggc gct gga gga ggc att ggt tgt cct tca gcg          672
Phe Arg Thr Arg Ile Gly Ala Gly Gly Gly Ile Gly Cys Pro Ser Ala
        210                 215                 220

gcc ctc gca gcc ttt gat atg ggt gcg agt ttt gtc gtg act gga agc          720
Ala Leu Ala Ala Phe Asp Met Gly Ala Ser Phe Val Val Thr Gly Ser
225                 230                 235                 240

ata aat caa att tgc cgc gag gca ggg act tgc gat act gtt cgg gag          768
Ile Asn Gln Ile Cys Arg Glu Ala Gly Thr Cys Asp Thr Val Arg Glu
                245                 250                 255

cta ctt gcc aac tca agc tac tcg gac gtg acg atg gcg cca gca gca          816
Leu Leu Ala Asn Ser Ser Tyr Ser Asp Val Thr Met Ala Pro Ala Ala
            260                 265                 270

gac atg ttt gac caa ggt gtg aaa ctc caa gtc tta aaa cga gga acg          864
Asp Met Phe Asp Gln Gly Val Lys Leu Gln Val Leu Lys Arg Gly Thr
        275                 280                 285

atg ttt cca agc aga gca aat aaa ctc cgg aag ctc ttt gtg aac tac          912
Met Phe Pro Ser Arg Ala Asn Lys Leu Arg Lys Leu Phe Val Asn Tyr
        290                 295                 300

gaa tct cta gaa aca ctc ccg tcg aaa gag ttg aaa tac ctg gaa aac          960
Glu Ser Leu Glu Thr Leu Pro Ser Lys Glu Leu Lys Tyr Leu Glu Asn
305                 310                 315                 320

atc ata ttc aag caa gca gta gac cag gtg tgg gag gaa aca aag cgc         1008
Ile Ile Phe Lys Gln Ala Val Asp Gln Val Trp Glu Glu Thr Lys Arg
                325                 330                 335

ttt tac tgt gaa aaa ctg aac aat cca gat aaa att gca agg gcc atg         1056
Phe Tyr Cys Glu Lys Leu Asn Asn Pro Asp Lys Ile Ala Arg Ala Met
                340                 345                 350

aaa gat cct aaa ttg aag atg tcg ctt tgc ttt cgg tgg tat ctc tcc         1104
Lys Asp Pro Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Ser
            355                 360                 365

aag agc tct ggg tgg gcc aac gca gga att aaa tct cgt gca ctc gac         1152
Lys Ser Ser Gly Trp Ala Asn Ala Gly Ile Lys Ser Arg Ala Leu Asp
        370                 375                 380

tac cag atc tgg tgt ggc ccg gca atg ggc tcg ttc aac aat ttc gcc         1200
Tyr Gln Ile Trp Cys Gly Pro Ala Met Gly Ser Phe Asn Asn Phe Ala
385                 390                 395                 400

agc ggc aca tcc ctc gat tgg aaa gtg act ggg gtt ttc cct ggc gtt         1248
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179

Ser Gly Thr Ser Leu Asp Trp Lys Val Thr Gly Val Phe Pro Gly Val
                405   410   415

gcg gaa gta aac atg gcc att tta gat ggc gcg cga gaa cta gct gct   1296
Ala Glu Val Asn Met Ala Ile Leu Asp Gly Ala Arg Glu Leu Ala Ala
            420   425   430

aaa cga aat   1305
Lys Arg Asn
        435

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<213> Thraustochytrium sp.

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Asn Thr Arg Tyr Ser Leu Tyr Thr Gly Ala Met Ala Lys Gly Ile Ala
1   5   10   15

Ser Ala Asp Leu Val Ile Ala Ala Gly Lys Glu Gly Ile Leu Ala Ser
            20   25   30

Tyr Gly Ala Gly Gly Leu Pro Leu Ala Thr Val Arg Lys Gly Ile Asp
        35   40   45

Lys Ile Gln Gln Ala Leu Pro Ser Gly Pro Tyr Ala Val Asn Leu Ile
    50   55   60

His Ser Pro Phe Asp Gly Asn Leu Glu Gln Gly Asn Val Asp Leu Phe
65   70   75   80

Leu Glu Lys Asn Val Arg Val Ala Glu Cys Ser Ala Phe Thr Thr Leu
                85   90   95

Thr Val Pro Val Val His Tyr Arg Ala Ala Gly Leu Val Arg Arg Gln
            100   105   110

Asp Gly Ser Ile Leu Ile Lys Asn Arg Ile Ile Ala Lys Val Ser Arg
            115   120   125

Thr Glu Leu Ala Glu Met Phe Leu Arg Pro Ala Pro Gln Ile Ile Leu
    130   135   140

Glu Lys Leu Val Ala Ala Glu Ile Ile Ser Ser Asp Gln Ala Arg Met
145   150   155   160

Ala Ala Lys Val Pro Met Ala Asp Asp Ile Ala Val Glu Ala Asp Ser
            165   170   175

Gly Gly His Thr Asp Asn Arg Pro Met His Val Ile Leu Pro Leu Ile
            180   185   190

Ile Gln Leu Arg Asn Thr Ile Leu Ala Glu Tyr Gly Cys Ala Thr Ala

180

Phe Arg Thr Arg Ile Gly Ala Gly Gly Gly Ile Gly Cys Pro Ser Ala
    210   215   220

Ala Leu Ala Ala Phe Asp Met Gly Ala Ser Phe Val Val Thr Gly Ser
225   230   235   240

Ile Asn Gln Ile Cys Arg Glu Ala Gly Thr Cys Asp Thr Val Arg Glu
            245   250   255

Leu Leu Ala Asn Ser Ser Tyr Ser Asp Val Thr Met Ala Pro Ala Ala
            260   265   270

Asp Met Phe Asp Gln Gly Val Lys Leu Gln Val Leu Lys Arg Gly Thr
        275   280   285

Met Phe Pro Ser Arg Ala Asn Lys Leu Arg Lys Leu Phe Val Asn Tyr
    290   295   300

Glu Ser Leu Glu Thr Leu Pro Ser Lys Glu Leu Lys Tyr Leu Glu Asn
305   310   315   320

Ile Ile Phe Lys Gln Ala Val Asp Gln Val Trp Glu Glu Thr Lys Arg
            325   330   335

Phe Tyr Cys Glu Lys Leu Asn Asn Pro Asp Lys Ile Ala Arg Ala Met
            340   345   350

Lys Asp Pro Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Ser
        355   360   365

Lys Ser Ser Gly Trp Ala Asn Ala Gly Ile Lys Ser Arg Ala Leu Asp
    370   375   380

Tyr Gln Ile Trp Cys Gly Pro Ala Met Gly Ser Phe Asn Asn Phe Ala
385   390   395   400

Ser Gly Thr Ser Leu Asp Trp Lys Val Thr Gly Val Phe Pro Gly Val
            405   410   415

Ala Glu Val Asn Met Ala Ile Leu Asp Gly Ala Arg Glu Leu Ala Ala
            420   425   430

Lys Arg Asn
        435

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Met Gly Pro Arg Val Ala Ser Gly Lys Val Pro Ala Trp Glu Met Ser
1               5                   10                  15

aag tcc gag ctg tgt gat gac cgc acg gta gtc ttt gac tat gag gag        96
Lys Ser Glu Leu Cys Asp Asp Arg Thr Val Val Phe Asp Tyr Glu Glu
            20                  25                  30

ctg ctg gag ttc gct gag ggc gat atc agt aag gtt ttt ggg ccg gag       144
Leu Leu Glu Phe Ala Glu Gly Asp Ile Ser Lys Val Phe Gly Pro Glu
        35                  40                  45

ttc aaa gtg gtg gac ggg ttt agg cgc agg gtg agg ttg ccc gct cga       192
Phe Lys Val Val Asp Gly Phe Arg Arg Arg Val Arg Leu Pro Ala Arg
    50                  55                  60

gag tac ctg ctg gtg acc cgg gtt acg ctg atg gat gcc gag gtg ggc       240
Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Gly
65                  70                  75                  80

aac ttt cga gtg gga gca cgt atg gtg aca gag tat gac gta cct gtg       288
Asn Phe Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Val Pro Val
                85                  90                  95

aac gga gag ctc tcg gaa ggg gga gat gtg ccg tgg gct gtg ttg gtg       336
Asn Gly Glu Leu Ser Glu Gly Gly Asp Val Pro Trp Ala Val Leu Val
            100                 105                 110

gaa gcc ggg cag tgc gac ttg ctg cta att tct tac atg ggc atc gat       384
Glu Ala Gly Gln Cys Asp Leu Leu Leu Ile Ser Tyr Met Gly Ile Asp
        115                 120                 125

ttc cag tgc aaa gga gag cgg gtc tac cgg ctg ctg aac acc acc ttg       432
Phe Gln Cys Lys Gly Glu Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu
    130                 135                 140

acg ttt ttt ggc gtc gcg aaa gaa ggg gaa acg ctt gtg tac gat att       480
Thr Phe Phe Gly Val Ala Lys Glu Gly Glu Thr Leu Val Tyr Asp Ile
145                 150                 155                 160

cgc gtc acg ggt ttc gcc aag agg ccg gac gga gat atc tcc atg ttc       528
Arg Val Thr Gly Phe Ala Lys Arg Pro Asp Gly Asp Ile Ser Met Phe
                165                 170                 175

ttt ttc gaa tat gat tgc tac tgc aat ggc aag ctt ctc atc gaa atg       576
Phe Phe Glu Tyr Asp Cys Tyr Cys Asn Gly Lys Leu Leu Ile Glu Met
                180                 185                 190

cga gat ggc tct gca ggc ttc ttc acg gac gaa gag ctc gct gcc ggc       624
Arg Asp Gly Ser Ala Gly Phe Phe Thr Asp Glu Glu Leu Ala Ala Gly
        195                 200                 205

aaa gga gtg gtc gtc act cgt gca cag caa aac atg cgg gac aaa att       672
Lys Gly Val Val Val Thr Arg Ala Gln Gln Asn Met Arg Asp Lys Ile
        210                 215                 220

gta cgg cag tcc att gag cct ttt gca ctg gcg gct tgc acg cac aaa       720
Val Arg Gln Ser Ile Glu Pro Phe Ala Leu Ala Ala Cys Thr His Lys
225                 230                 235                 240

acg act ctg aac gag agt gac atg cag tcc ctt gtg gag cga aac tgg       768
Thr Thr Leu Asn Glu Ser Asp Met Gln Ser Leu Val Glu Arg Asn Trp
                245                 250                 255
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182

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gca aac gtt ttt ggc acc agt aac aag atg gcg gag ctc aac tat aaa        816
Ala Asn Val Phe Gly Thr Ser Asn Lys Met Ala Glu Leu Asn Tyr Lys
            260                 265                 270

att tgc gcc agg aaa atg ctc atg atc gac agg gtt acc cac att gac        864
Ile Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr His Ile Asp
        275                 280                 285

cac cac ggt ggg gcg tat ggc ctc gga cta ctt gtt gga gag aag atc       912
His His Gly Gly Ala Tyr Gly Leu Gly Leu Leu Val Gly Glu Lys Ile
        290                 295                 300

ttg gat cga aac cat tgg tac ttt cct tgt cac ttt gtc aat gat caa       960
Leu Asp Arg Asn His Trp Tyr Phe Pro Cys His Phe Val Asn Asp Gln
305                 310                 315                 320

gtc atg gca ggg tca ctg gtc agc gat ggt tgc agc cag ctc tta aaa      1008
Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Leu Leu Lys
                325                 330                 335

ctc tat atg atc tgg ctt ggc ctc cac ctg aaa atg gag gaa ttt gat      1056
Leu Tyr Met Ile Trp Leu Gly Leu His Leu Lys Met Glu Glu Phe Asp
            340                 345                 350

ttt ctc cca gtt agc ggc cac aaa aac aag gtg cga tgc agg gga caa      1104
Phe Leu Pro Val Ser Gly His Lys Asn Lys Val Arg Cys Arg Gly Gln
        355                 360                 365

att tca ccg cat aaa ggc aag ctt gtc tac gtc atg gaa atc aaa aag      1152
Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Lys
        370                 375                 380

atg ggt tac gat caa gca tct gga agc cca tac gcc atc gcg gac gtt      1200
Met Gly Tyr Asp Gln Ala Ser Gly Ser Pro Tyr Ala Ile Ala Asp Val
385                 390                 395                 400

gat atc att gac gtc aac gaa gag ctg ggt caa agt ttt gac atc aac      1248
Asp Ile Ile Asp Val Asn Glu Glu Leu Gly Gln Ser Phe Asp Ile Asn
                405                 410                 415

gac ctt gcg agc tac gga aaa ggt gac ctg agc aaa aaa atc gtg gtt      1296
Asp Leu Ala Ser Tyr Gly Lys Gly Asp Leu Ser Lys Lys Ile Val Val
            420                 425                 430

gac ttc aaa gga att gct ttg cag ctc aaa ggc cgc gct ttt tca cgc      1344
Asp Phe Lys Gly Ile Ala Leu Gln Leu Lys Gly Arg Ala Phe Ser Arg
            435                 440                 445

atg agt tcc agc tcg tcc ttg aac gaa gga tgg caa tgt gtt cca aaa      1392
Met Ser Ser Ser Ser Ser Leu Asn Glu Gly Trp Gln Cys Val Pro Lys
        450                 455                 460

cca agc cag aga atg gaa cac gaa cag ccc cct gct cac tgc ctt gca      1440
Pro Ser Gln Arg Met Glu His Glu Gln Pro Pro Ala His Cys Leu Ala
465                 470                 475                 480

agc gac ccc gaa gcc cct tca act gtg acc tgg cac cca atg tca aag      1488
Ser Asp Pro Glu Ala Pro Ser Thr Val Thr Trp His Pro Met Ser Lys
                485                 490                 495

ctt cct ggc aac cct acg ccg ttc ttc tcc cct tca tct tac cct ccg      1536
Leu Pro Gly Asn Pro Thr Pro Phe Phe Ser Pro Ser Ser Tyr Pro Pro
            500                 505                 510

agg gca att tgc ttc atc cct ttc ccg ggc aat ccc ctt gac aac aac      1584
Arg Ala Ile Cys Phe Ile Pro Phe Pro Gly Asn Pro Leu Asp Asn Asn
            515                 520                 525
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183

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tgc aag gct gga gaa atg ccc ctg aac tgg tac aac atg tca gag ttc      1632
Cys Lys Ala Gly Glu Met Pro Leu Asn Trp Tyr Asn Met Ser Glu Phe
    530             535                 540

atg tgt ggc aag gtt tct aac tgc ttg ggc cca gaa ttc gca cgc ttt      1680
Met Cys Gly Lys Val Ser Asn Cys Leu Gly Pro Glu Phe Ala Arg Phe
545             550                 555                 560

gac aag tcg aac acc agc cgg agc cct gct ttt gac ttg gct ctg gtg      1728
Asp Lys Ser Asn Thr Ser Arg Ser Pro Ala Phe Asp Leu Ala Leu Val
                565                 570                 575

acc cga gtt gtt gaa gtc aca aac atg gaa cac ggc aag ttt cta aac      1776
Thr Arg Val Val Glu Val Thr Asn Met Glu His Gly Lys Phe Leu Asn
                580                 585                 590

gtt gat tgc aat cca agc aaa ggc aca atg gtg ggg gag ttt gac tgt      1824
Val Asp Cys Asn Pro Ser Lys Gly Thr Met Val Gly Glu Phe Asp Cys
            595                 600                 605

ccc caa gac gcg tgg ttc ttt gat ggt tcg tgc aac gac ggc cat atg      1872
Pro Gln Asp Ala Trp Phe Phe Asp Gly Ser Cys Asn Asp Gly His Met
            610                 615                 620

ccg tat tcc att atc atg gaa atc gga ctg caa acc tca ggt gtt ctc      1920
Pro Tyr Ser Ile Ile Met Glu Ile Gly Leu Gln Thr Ser Gly Val Leu
625                 630                 635                 640

acc tcg gtg ttg aag gca ccg ctg act atg gac aag gat gac att ctc      1968
Thr Ser Val Leu Lys Ala Pro Leu Thr Met Asp Lys Asp Asp Ile Leu
                645                 650                 655

ttt cga aac ctc gat gca agt gct gaa atg gtg cgt cca gac gtg gat      2016
Phe Arg Asn Leu Asp Ala Ser Ala Glu Met Val Arg Pro Asp Val Asp
                660                 665                 670

gtt cgc ggc aaa acg att cga aac gtg acc aag tgt acc ggc tat gca      2064
Val Arg Gly Lys Thr Ile Arg Asn Val Thr Lys Cys Thr Gly Tyr Ala
            675                 680                 685

atg ttg gga aag atg ggg att cac cgg ttc acg ttt gag ttg agc gtt      2112
Met Leu Gly Lys Met Gly Ile His Arg Phe Thr Phe Glu Leu Ser Val
            690                 695                 700

gac ggc gtg gta ttt tat aaa gga tcc act tcc ttt gga tgg ttc act      2160
Asp Gly Val Val Phe Tyr Lys Gly Ser Thr Ser Phe Gly Trp Phe Thr
705                 710                 715                 720

ccc gag gtg ttt gct cag caa gct gga ctc gac aac ggg aaa aag acg      2208
Pro Glu Val Phe Ala Gln Gln Ala Gly Leu Asp Asn Gly Lys Lys Thr
                725                 730                 735

gag ccc tgg tgc aag act aac aac acc tcg gtt cga aga gtt gaa atc      2256
Glu Pro Trp Cys Lys Thr Asn Asn Thr Ser Val Arg Arg Val Glu Ile
            740                 745                 750

gca tcc gcc aaa gga aaa gag cag ctg act gag aag ctt ccc gac gca      2304
Ala Ser Ala Lys Gly Lys Glu Gln Leu Thr Glu Lys Leu Pro Asp Ala
            755                 760                 765

act aat gct caa gtt ctt cgg cgt tca gag cag tgt gaa tac ctc gat      2352
Thr Asn Ala Gln Val Leu Arg Arg Ser Glu Gln Cys Glu Tyr Leu Asp
    770                 775                 780

tac ctc aat att gcc cct gac tct ggg ctg cat ggg aag ggc tac gcc      2400
Tyr Leu Asn Ile Ala Pro Asp Ser Gly Leu His Gly Lys Gly Tyr Ala
785                 790                 795             800
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184

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cac gga cac aaa gac gtt aac ccg caa gac tgg ttc ttc tct tgc cac    2448
His Gly His Lys Asp Val Asn Pro Gln Asp Trp Phe Phe Ser Cys His
                805                 810                 815

ttt tgg ttc gat cct gta atg cca gga tct tta gga att gaa tca atg    2496
Phe Trp Phe Asp Pro Val Met Pro Gly Ser Leu Gly Ile Glu Ser Met
                820                 825                 830

ttc cag ctt atc gag gcc ttt gcg gtg gac caa aac att cct gga gag    2544
Phe Gln Leu Ile Glu Ala Phe Ala Val Asp Gln Asn Ile Pro Gly Glu
                835                 840                 845

tac aac gta tcc aat ccg acc ttt gcc cat gca cca ggc aaa acg gcg    2592
Tyr Asn Val Ser Asn Pro Thr Phe Ala His Ala Pro Gly Lys Thr Ala
                850                 855                 860

tgg aaa tac cga ggc cag ctc aca cca aag aac cgt gcg atg gac tgc    2640
Trp Lys Tyr Arg Gly Gln Leu Thr Pro Lys Asn Arg Ala Met Asp Cys
865                 870                 875                 880

gag gtg cat atc gtt tca att acc gcc tcc ccc gag aac ggg ggc tac    2688
Glu Val His Ile Val Ser Ile Thr Ala Ser Pro Glu Asn Gly Gly Tyr
                885                 890                 895

gtt gac atc gtg gcc gat gga gcg ctt tgg gta gat gga ctt cgc gtg    2736
Val Asp Ile Val Ala Asp Gly Ala Leu Trp Val Asp Gly Leu Arg Val
                900                 905                 910

tac gaa gcc aaa gag ctt cga gtt cgt gtc gtt tcg gca aaa cct caa    2784
Tyr Glu Ala Lys Glu Leu Arg Val Arg Val Val Ser Ala Lys Pro Gln
                915                 920                 925

gca att ccg gat gta caa caa cag cca cct agc gca aag gcg gac ccg    2832
Ala Ile Pro Asp Val Gln Gln Gln Pro Pro Ser Ala Lys Ala Asp Pro
                930                 935                 940

ggg aaa aca gga gtt gca ctt tcg ccc act cag cta cgc gac gtc ctg    2880
Gly Lys Thr Gly Val Ala Leu Ser Pro Thr Gln Leu Arg Asp Val Leu
945                 950                 955                 960

ctt gaa gtg gac aat cca ttg tat ctt ggt gta gag aac tcc aat ttg    2928
Leu Glu Val Asp Asn Pro Leu Tyr Leu Gly Val Glu Asn Ser Asn Leu
                965                 970                 975

gtg cag ttt gag tcg aaa cct gca act tct tca cgt atc gtt tcg atc    2976
Val Gln Phe Glu Ser Lys Pro Ala Thr Ser Ser Arg Ile Val Ser Ile
                980                 985                 990

aaa ccg tgc tcg att agt gac ctt  ggc gat aag tct ttt  atg gaa acg    3024
Lys Pro Cys Ser Ile Ser Asp Leu  Gly Asp Lys Ser Phe  Met Glu Thr
                995                 1000                1005

tac aac  gtg tca gca cct ctg  tat act gga gca atg  gcc aag ggc    3069
Tyr Asn  Val Ser Ala Pro Leu  Tyr Thr Gly Ala Met  Ala Lys Gly
    1010                1015                1020

att gca  tcc gcc gac ttg gtc  att gct gct ggg aaa  cgc aag ata    3114
Ile Ala  Ser Ala Asp Leu Val  Ile Ala Ala Gly Lys  Arg Lys Ile
    1025                1030                1035

ctt gga  tcg ttt ggt gcg gga  ggg ctg cct att tcc  ata gtc cgt    3159
Leu Gly  Ser Phe Gly Ala Gly  Gly Leu Pro Ile Ser  Ile Val Arg
    1040                1045                1050

gaa gca  ctg gag aaa att caa  caa cac ctg ccc cac  ggc ccc tac    3204
Glu Ala  Leu Glu Lys Ile Gln  Gln His Leu Pro His  Gly Pro Tyr
    1055                1060                1065
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gct gtt aac ctc att cac tcg cct ttc gac agc aac ttg gaa aag      3249
Ala Val Asn Leu Ile His Ser Pro Phe Asp Ser Asn Leu Glu Lys
    1070            1075                1080

ggc aac gtt gac ctc ttt ctc gag atg ggc gtg aca gtg gta gaa      3294
Gly Asn Val Asp Leu Phe Leu Glu Met Gly Val Thr Val Val Glu
    1085            1090                1095

tgc agc gcg ttc atg gaa ctc acg gcc cag gtt gtc cgg tac cgc      3339
Cys Ser Ala Phe Met Glu Leu Thr Ala Gln Val Val Arg Tyr Arg
    1100            1105                1110

gcg tct ggt cta agc aaa agt gcg gac ggt tcg att cgc att gct      3384
Ala Ser Gly Leu Ser Lys Ser Ala Asp Gly Ser Ile Arg Ile Ala
    1115            1120                1125

cac cgt att att ggc aag gtt tcc aga acc gag ctg gca gaa atg      3429
His Arg Ile Ile Gly Lys Val Ser Arg Thr Glu Leu Ala Glu Met
    1130            1135                1140

ttt att cgt cca gca cca cag cac ctc ctc caa aaa ctc gta gcc      3474
Phe Ile Arg Pro Ala Pro Gln His Leu Leu Gln Lys Leu Val Ala
    1145            1150                1155

tcc ggc gag ctg aca gct gag caa gcc gag ctt gca aca cag gtt      3519
Ser Gly Glu Leu Thr Ala Glu Gln Ala Glu Leu Ala Thr Gln Val
    1160            1165                1170

ccg gtg gcg gat gac att gcg gtc gaa gcc gac tcg ggg ggg cat      3564
Pro Val Ala Asp Asp Ile Ala Val Glu Ala Asp Ser Gly Gly His
    1175            1180                1185

acc gac aac agg cct att cac gtc att ctt cct cta atc atc aac      3609
Thr Asp Asn Arg Pro Ile His Val Ile Leu Pro Leu Ile Ile Asn
    1190            1195                1200

cta cgc aac cgt ttg cat aaa gag ctt gac tac cct tcg cat ctc      3654
Leu Arg Asn Arg Leu His Lys Glu Leu Asp Tyr Pro Ser His Leu
    1205            1210                1215

cgg gta cgt gtg ggt gct ggt ggt ggt att gga tgt cct caa gcc      3699
Arg Val Arg Val Gly Ala Gly Gly Gly Ile Gly Cys Pro Gln Ala
    1220            1225                1230

gct ctt gca gca ttt caa atg ggg gca gcg ttt tta atc act gga      3744
Ala Leu Ala Ala Phe Gln Met Gly Ala Ala Phe Leu Ile Thr Gly
    1235            1240                1245

acg gtg aac cag ctt gct cgt gaa agt ggc act tgt gac aac gtc      3789
Thr Val Asn Gln Leu Ala Arg Glu Ser Gly Thr Cys Asp Asn Val
    1250            1255                1260

cgg tta cag ctc tca aag gcc acg tat agc gac gtg tgt atg gct      3834
Arg Leu Gln Leu Ser Lys Ala Thr Tyr Ser Asp Val Cys Met Ala
    1265            1270                1275

cct gct gcc gat atg ttt gac caa ggc gtg gag ctg caa gta ttg      3879
Pro Ala Ala Asp Met Phe Asp Gln Gly Val Glu Leu Gln Val Leu
    1280            1285                1290

aag aaa ggc acg ctg ttc cca agt cgt gct aag aag ctg tac gag      3924
Lys Lys Gly Thr Leu Phe Pro Ser Arg Ala Lys Lys Leu Tyr Glu
    1295            1300                1305

ctg ttc tgc aag tat gac tcg ttt gag gca atg ccg gct gaa gaa      3969
Leu Phe Cys Lys Tyr Asp Ser Phe Glu Ala Met Pro Ala Glu Glu
    1310            1315                1320
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ttg caa  cgg gtt gaa aag cgg  att ttt caa aag tcg  ctt gct gaa        4014
Leu Gln  Arg Val Glu Lys Arg  Ile Phe Gln Lys Ser  Leu Ala Glu
    1325             1330               1335

gtt tgg  cag gag acc agt gac  ttt tac att cat cgt  atc aag aac        4059
Val Trp  Gln Glu Thr Ser Asp  Phe Tyr Ile His Arg  Ile Lys Asn
    1340             1345               1350

cct gag  aaa atc aat cgt gct  gca agc gat ggc aaa  ctg aaa atg        4104
Pro Glu  Lys Ile Asn Arg Ala  Ala Ser Asp Gly Lys  Leu Lys Met
    1355             1360               1365

tcg ctt  tgc ttt cgc tgg tac  ctt ggg ctt tcc tca  ttt tgg gcc        4149
Ser Leu  Cys Phe Arg Trp Tyr  Leu Gly Leu Ser Ser  Phe Trp Ala
    1370             1375               1380

aac tct  ggg gca caa gat cgc  gtc atg gac tat caa  att tgg tgt        4194
Asn Ser  Gly Ala Gln Asp Arg  Val Met Asp Tyr Gln  Ile Trp Cys
    1385             1390               1395

ggc cct  gct att ggc gct ttc  aat gat ttt acc aag  ggc acg tac        4239
Gly Pro  Ala Ile Gly Ala Phe  Asn Asp Phe Thr Lys  Gly Thr Tyr
    1400             1405               1410

ctt gac  gtg act gtt gca aag  agt tac cct tgt gtg  gca cag atc        4284
Leu Asp  Val Thr Val Ala Lys  Ser Tyr Pro Cys Val  Ala Gln Ile
    1415             1420               1425

aat ttg  caa att ttg caa gga  gct gcg tat ctg aaa  cgc ctt ggt        4329
Asn Leu  Gln Ile Leu Gln Gly  Ala Ala Tyr Leu Lys  Arg Leu Gly
    1430             1435               1440

gtc att  cgt ttt gac cgc atg  ctg ctg cag gcc gtc  gat atc gac        4374
Val Ile  Arg Phe Asp Arg Met  Leu Leu Gln Ala Val  Asp Ile Asp
    1445             1450               1455

gat cct  gta ttt act tac gtg  ccg acc cag cca ctt                     4410
Asp Pro  Val Phe Thr Tyr Val  Pro Thr Gln Pro Leu
    1460             1465               1470


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<212>  PRT
<213>  Thraustochytrium sp.

<400>  62

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1               5                   10                  15


Lys Ser Glu Leu Cys Asp Asp Arg Thr Val Val Phe Asp Tyr Glu Glu
            20                  25                  30


Leu Leu Glu Phe Ala Glu Gly Asp Ile Ser Lys Val Phe Gly Pro Glu
            35                  40                  45


Phe Lys Val Val Asp Gly Phe Arg Arg Arg Val Arg Leu Pro Ala Arg
    50                  55                  60


Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Gly
65                  70                  75                  80
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187

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Asn Phe Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Val Pro Val
              85                      90                  95

Asn Gly Glu Leu Ser Glu Gly Gly Asp Val Pro Trp Ala Val Leu Val
             100                     105             110

Glu Ala Gly Gln Cys Asp Leu Leu Leu Ile Ser Tyr Met Gly Ile Asp
         115             120                 125

Phe Gln Cys Lys Gly Glu Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu
     130             135             140

Thr Phe Phe Gly Val Ala Lys Glu Gly Glu Thr Leu Val Tyr Asp Ile
145              150             155                 160

Arg Val Thr Gly Phe Ala Lys Arg Pro Asp Gly Asp Ile Ser Met Phe
             165             170                 175

Phe Phe Glu Tyr Asp Cys Tyr Cys Asn Gly Lys Leu Leu Ile Glu Met
             180             185             190

Arg Asp Gly Ser Ala Gly Phe Phe Thr Asp Glu Glu Leu Ala Ala Gly
         195             200             205

Lys Gly Val Val Val Thr Arg Ala Gln Gln Asn Met Arg Asp Lys Ile
    210             215             220

Val Arg Gln Ser Ile Glu Pro Phe Ala Leu Ala Ala Cys Thr His Lys
225             230             235                 240

Thr Thr Leu Asn Glu Ser Asp Met Gln Ser Leu Val Glu Arg Asn Trp
             245             250             255

Ala Asn Val Phe Gly Thr Ser Asn Lys Met Ala Glu Leu Asn Tyr Lys
             260             265             270

Ile Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr His Ile Asp
         275             280             285

His His Gly Gly Ala Tyr Gly Leu Gly Leu Leu Val Gly Glu Lys Ile
    290             295             300

Leu Asp Arg Asn His Trp Tyr Phe Pro Cys His Phe Val Asn Asp Gln
305             310             315                 320

Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Leu Leu Lys
             325             330             335

Leu Tyr Met Ile Trp Leu Gly Leu His Leu Lys Met Glu Glu Phe Asp
             340             345             350
```

188

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Phe Leu Pro Val Ser Gly His Lys Asn Lys Val Arg Cys Arg Gly Gln
        355                 360                 365

Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Lys
        370             375                 380

Met Gly Tyr Asp Gln Ala Ser Gly Ser Pro Tyr Ala Ile Ala Asp Val
385                 390                 395                 400

Asp Ile Ile Asp Val Asn Glu Glu Leu Gly Gln Ser Phe Asp Ile Asn
                405                 410                 415

Asp Leu Ala Ser Tyr Gly Lys Gly Asp Leu Ser Lys Lys Ile Val Val
            420                 425                 430

Asp Phe Lys Gly Ile Ala Leu Gln Leu Lys Gly Arg Ala Phe Ser Arg
        435                 440                 445

Met Ser Ser Ser Ser Ser Leu Asn Glu Gly Trp Gln Cys Val Pro Lys
        450                 455                 460

Pro Ser Gln Arg Met Glu His Glu Gln Pro Pro Ala His Cys Leu Ala
465                 470                 475                 480

Ser Asp Pro Glu Ala Pro Ser Thr Val Thr Trp His Pro Met Ser Lys
                485                 490                 495

Leu Pro Gly Asn Pro Thr Pro Phe Phe Ser Pro Ser Ser Tyr Pro Pro
            500                 505                 510

Arg Ala Ile Cys Phe Ile Pro Phe Pro Gly Asn Pro Leu Asp Asn Asn
            515                 520                 525

Cys Lys Ala Gly Glu Met Pro Leu Asn Trp Tyr Asn Met Ser Glu Phe
        530                 535                 540

Met Cys Gly Lys Val Ser Asn Cys Leu Gly Pro Glu Phe Ala Arg Phe
545                 550                 555                 560

Asp Lys Ser Asn Thr Ser Arg Ser Pro Ala Phe Asp Leu Ala Leu Val
                565                 570                 575

Thr Arg Val Val Glu Val Thr Asn Met Glu His Gly Lys Phe Leu Asn
            580                 585                 590

Val Asp Cys Asn Pro Ser Lys Gly Thr Met Val Gly Glu Phe Asp Cys
            595                 600                 605

Pro Gln Asp Ala Trp Phe Phe Asp Gly Ser Cys Asn Asp Gly His Met
    610                 615                 620
```

189

Pro Tyr Ser Ile Ile Met Glu Ile Gly Leu Gln Thr Ser Gly Val Leu
625   630   635   640

Thr Ser Val Leu Lys Ala Pro Leu Thr Met Asp Lys Asp Asp Ile Leu
            645   650   655

Phe Arg Asn Leu Asp Ala Ser Ala Glu Met Val Arg Pro Asp Val Asp
            660   665   670

Val Arg Gly Lys Thr Ile Arg Asn Val Thr Lys Cys Thr Gly Tyr Ala
        675   680   685

Met Leu Gly Lys Met Gly Ile His Arg Phe Thr Phe Glu Leu Ser Val
    690   695   700

Asp Gly Val Val Phe Tyr Lys Gly Ser Thr Ser Phe Gly Trp Phe Thr
705   710   715   720

Pro Glu Val Phe Ala Gln Gln Ala Gly Leu Asp Asn Gly Lys Lys Thr
            725   730   735

Glu Pro Trp Cys Lys Thr Asn Asn Thr Ser Val Arg Arg Val Glu Ile
        740   745   750

Ala Ser Ala Lys Gly Lys Glu Gln Leu Thr Glu Lys Leu Pro Asp Ala
    755   760   765

Thr Asn Ala Gln Val Leu Arg Arg Ser Glu Gln Cys Glu Tyr Leu Asp
    770   775   780

Tyr Leu Asn Ile Ala Pro Asp Ser Gly Leu His Gly Lys Gly Tyr Ala
785   790   795   800

His Gly His Lys Asp Val Asn Pro Gln Asp Trp Phe Phe Ser Cys His
            805   810   815

Phe Trp Phe Asp Pro Val Met Pro Gly Ser Leu Gly Ile Glu Ser Met
            820   825   830

Phe Gln Leu Ile Glu Ala Phe Ala Val Asp Gln Asn Ile Pro Gly Glu
        835   840   845

Tyr Asn Val Ser Asn Pro Thr Phe Ala His Ala Pro Gly Lys Thr Ala
    850   855   860

Trp Lys Tyr Arg Gly Gln Leu Thr Pro Lys Asn Arg Ala Met Asp Cys
865   870   875   880

Glu Val His Ile Val Ser Ile Thr Ala Ser Pro Glu Asn Gly Gly Tyr
            885   890   895

190

```
Val Asp Ile Val Ala Asp Gly Ala Leu Trp Val Asp Gly Leu Arg Val
        900                   905                 910

Tyr Glu Ala Lys Glu Leu Arg Val Arg Val Val Ser Ala Lys Pro Gln
        915                   920                 925

Ala Ile Pro Asp Val Gln Gln Gln Pro Pro Ser Ala Lys Ala Asp Pro
    930                   935                 940

Gly Lys Thr Gly Val Ala Leu Ser Pro Thr Gln Leu Arg Asp Val Leu
945                   950                 955                 960

Leu Glu Val Asp Asn Pro Leu Tyr Leu Gly Val Glu Asn Ser Asn Leu
                965                 970                 975

Val Gln Phe Glu Ser Lys Pro Ala Thr Ser Ser Arg Ile Val Ser Ile
        980                   985                 990

Lys Pro Cys Ser Ile Ser Asp Leu  Gly Asp Lys Ser Phe  Met Glu Thr
        995                 1000                 1005

Tyr Asn  Val Ser Ala Pro Leu  Tyr Thr Gly Ala Met  Ala Lys Gly
    1010                 . 1015                1020

Ile Ala  Ser Ala Asp Leu Val  Ile Ala Ala Gly Lys  Arg Lys Ile
    1025                 1030 .               1035

Leu Gly  Ser Phe Gly Ala Gly  Gly Leu Pro Ile Ser  Ile Val Arg
    1040                 1045                 1050

Glu Ala  Leu Glu Lys Ile Gln  Gln His Leu Pro His  Gly Pro Tyr
    1055                 1060                 1065

Ala Val  Asn Leu Ile His Ser  Pro Phe Asp Ser Asn  Leu Glu Lys
    1070                 1075                 1080

Gly Asn  Val Asp Leu Phe Leu  Glu Met Gly Val Thr  Val Val Glu
    1085                 1090                 1095

Cys Ser  Ala Phe Met Glu Leu  Thr Ala Gln Val Val  Arg Tyr Arg
    1100                 1105                 1110

Ala Ser  Gly Leu Ser Lys Ser  Ala Asp Gly Ser Ile  Arg Ile Ala
    1115                 1120                 1125

His Arg  Ile Ile Gly Lys Val  Ser Arg Thr Glu Leu  Ala Glu Met
    1130                 1135                 1140

Phe Ile  Arg Pro Ala Pro Gln  His Leu Leu Gln Lys  Leu Val Ala
    1145                 1150                 1155
```

```
Ser Gly  Glu Leu Thr Ala Glu  Gln Ala Glu Leu Ala  Thr Gln Val
    1160             1165             1170


Pro Val  Ala Asp Asp Ile Ala  Val Glu Ala Asp Ser  Gly Gly His
    1175             1180             1185


Thr Asp  Asn Arg Pro Ile His  Val Ile Leu Pro Leu  Ile Ile Asn
    1190             1195             1200


Leu Arg  Asn Arg Leu His Lys  Glu Leu Asp Tyr Pro  Ser His Leu
    1205             1210             1215


Arg Val  Arg Val Gly Ala Gly  Gly Gly Ile Gly Cys  Pro Gln Ala
    1220             1225             1230


Ala Leu  Ala Ala Phe Gln Met  Gly Ala Ala Phe Leu  Ile Thr Gly
    1235             1240             1245


Thr Val  Asn Gln Leu Ala Arg  Glu Ser Gly Thr Cys  Asp Asn Val
    1250             1255             1260


Arg Leu  Gln Leu Ser Lys Ala  Thr Tyr Ser Asp Val  Cys Met Ala
    1265             1270             1275


Pro Ala  Ala Asp Met Phe Asp  Gln Gly Val Glu Leu  Gln Val Leu
    1280             1285             1290


Lys Lys  Gly Thr Leu Phe Pro  Ser Arg Ala Lys Lys  Leu Tyr Glu
    1295             1300             1305


Leu Phe  Cys Lys Tyr Asp Ser  Phe Glu Ala Met Pro  Ala Glu Glu
    1310             1315             1320


Leu Gln  Arg Val Glu Lys Arg  Ile Phe Gln Lys Ser  Leu Ala Glu
    1325             1330             1335


Val Trp  Gln Glu Thr Ser Asp  Phe Tyr Ile His Arg  Ile Lys Asn
    1340             1345             1350


Pro Glu  Lys Ile Asn Arg Ala  Ala Ser Asp Gly Lys  Leu Lys Met
    1355             1360             1365


Ser Leu  Cys Phe Arg Trp Tyr  Leu Gly Leu Ser Ser  Phe Trp Ala
    1370             1375             1380


Asn Ser  Gly Ala Gln Asp Arg  Val Met Asp Tyr Gln  Ile Trp Cys
    1385             1390             1395


Gly Pro  Ala Ile Gly Ala Phe  Asn Asp Phe Thr Lys  Gly Thr Tyr
    1400             1405             1410
```

192

Leu Asp Val Thr Val Ala Lys Ser Tyr Pro Cys Val Ala Gln Ile
    1415   1420   1425

Asn Leu Gln Ile Leu Gln Gly Ala Ala Tyr Leu Lys Arg Leu Gly
    1430   1435   1440

Val Ile Arg Phe Asp Arg Met Leu Leu Gln Ala Val Asp Ile Asp
    1445   1450   1455

Asp Pro Val Phe Thr Tyr Val Pro Thr Gln Pro Leu
    1460   1465   1470

<210> 63
<211> 1500
<212> DNA
<213> Thraustochytrium sp.

<220>
<221> CDS
<222> (1)..(1500)

<400> 63
atg ggc ccg cga gtg gcg tca ggc aag gtg ccg gct tgg gag atg agc   48
Met Gly Pro Arg Val Ala Ser Gly Lys Val Pro Ala Trp Glu Met Ser
1   5   10   15

aag tcc gag ctg tgt gat gac cgc acg gta gtc ttt gac tat gag gag   96
Lys Ser Glu Leu Cys Asp Asp Arg Thr Val Val Phe Asp Tyr Glu Glu
                20   25   30

ctg ctg gag ttc gct gag ggc gat atc agt aag gtt ttt ggg ccg gag   144
Leu Leu Glu Phe Ala Glu Gly Asp Ile Ser Lys Val Phe Gly Pro Glu
            35   40   45

ttc aaa gtg gtg gac ggg ttt agg cgc agg gtg agg ttg ccc gct cga   192
Phe Lys Val Val Asp Gly Phe Arg Arg Arg Val Arg Leu Pro Ala Arg
        50   55   60

gag tac ctg ctg gtg acc cgg gtt acg ctg atg gat gcc gag gtg ggc   240
Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Gly
65   70   75   80

aac ttt cga gtg gga gca cgt atg gtg aca gag tat gac gta cct gtg   288
Asn Phe Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Val Pro Val
                85   90   95

aac gga gag ctc tcg gaa ggg gga gat gtg ccg tgg gct gtg ttg gtg   336
Asn Gly Glu Leu Ser Glu Gly Gly Asp Val Pro Trp Ala Val Leu Val
            100   105   110

gaa gcc ggg cag tgc gac ttg ctg cta att tct tac atg ggc atc gat   384
Glu Ala Gly Gln Cys Asp Leu Leu Leu Ile Ser Tyr Met Gly Ile Asp
            115   120   125

ttc cag tgc aaa gga gag cgg gtc tac cgg ctg ctg aac acc acc ttg   432
Phe Gln Cys Lys Gly Glu Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu
        130   135   140

acg ttt ttt ggc gtc gcg aaa gaa ggg gaa acg ctt gtg tac gat att   480
Thr Phe Phe Gly Val Ala Lys Glu Gly Glu Thr Leu Val Tyr Asp Ile
145   150   155   160

cgc gtc acg ggt ttc gcc aag agg ccg gac gga gat atc tcc atg ttc   528

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Arg Val Thr Gly Phe Ala Lys Arg Pro Asp Gly Asp Ile Ser Met Phe
            165                 170             175

ttt ttc gaa tat gat tgc tac tgc aat ggc aag ctt ctc atc gaa atg    576
Phe Phe Glu Tyr Asp Cys Tyr Cys Asn Gly Lys Leu Leu Ile Glu Met
            180                 185             190

cga gat ggc tct gca ggc ttc ttc acg gac gaa gag ctc gct gcc ggc    624
Arg Asp Gly Ser Ala Gly Phe Phe Thr Asp Glu Glu Leu Ala Ala Gly
            195                 200             205

aaa gga gtg gtc gtc act cgt gca cag caa aac atg cgg gac aaa att    672
Lys Gly Val Val Val Thr Arg Ala Gln Gln Asn Met Arg Asp Lys Ile
            210                 215             220

gta cgg cag tcc att gag cct ttt gca ctg gcg gct tgc acg cac aaa    720
Val Arg Gln Ser Ile Glu Pro Phe Ala Leu Ala Ala Cys Thr His Lys
225                 230             235                 240

acg act ctg aac gag agt gac atg cag tcc ctt gtg gag cga aac tgg    768
Thr Thr Leu Asn Glu Ser Asp Met Gln Ser Leu Val Glu Arg Asn Trp
            245                 250             255

gca aac gtt ttt ggc acc agt aac aag atg gcg gag ctc aac tat aaa    816
Ala Asn Val Phe Gly Thr Ser Asn Lys Met Ala Glu Leu Asn Tyr Lys
            260                 265             270

att tgc gcc agg aaa atg ctc atg atc gac agg gtt acc cac att gac    864
Ile Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr His Ile Asp
            275                 280             285

cac cac ggt ggg gcg tat ggc ctc gga cta ctt gtt gga gag aag atc    912
His His Gly Gly Ala Tyr Gly Leu Gly Leu Leu Val Gly Glu Lys Ile
            290                 295             300

ttg gat cga aac cat tgg tac ttt cct tgt cac ttt gtc aat gat caa    960
Leu Asp Arg Asn His Trp Tyr Phe Pro Cys His Phe Val Asn Asp Gln
305                 310             315                 320

gtc atg gca ggg tca ctg gtc agc gat ggt tgc agc cag ctc tta aaa   1008
Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Leu Leu Lys
            325                 330             335

ctc tat atg atc tgg ctt ggc ctc cac ctg aaa atg gag gaa ttt gat   1056
Leu Tyr Met Ile Trp Leu Gly Leu His Leu Lys Met Glu Glu Phe Asp
            340                 345             350

ttt ctc cca gtt agc ggc cac aaa aac aag gtg cga tgc agg gga caa   1104
Phe Leu Pro Val Ser Gly His Lys Asn Lys Val Arg Cys Arg Gly Gln
            355                 360             365

att tca ccg cat aaa ggc aag ctt gtc tac gtc atg gaa atc aaa aag   1152
Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Lys
            370                 375             380

atg ggt tac gat caa gca tct gga agc cca tac gcc atc gcg gac gtt   1200
Met Gly Tyr Asp Gln Ala Ser Gly Ser Pro Tyr Ala Ile Ala Asp Val
385                 390             395                 400

gat atc att gac gtc aac gaa gag ctg ggt caa agt ttt gac atc aac   1248
Asp Ile Ile Asp Val Asn Glu Glu Leu Gly Gln Ser Phe Asp Ile Asn
            405                 410             415

gac ctt gcg agc tac gga aaa ggt gac ctg agc aaa aaa atc gtg gtt   1296
Asp Leu Ala Ser Tyr Gly Lys Gly Asp Leu Ser Lys Lys Ile Val Val
            420                 425             430

gac ttc aaa gga att gct ttg cag ctc aaa ggc cgc gct ttt tca cgc   1344
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194

```
Asp Phe Lys Gly Ile Ala Leu Gln Leu Lys Gly Arg Ala Phe Ser Arg
        435                 440             445

atg agt tcc agc tcg tcc ttg aac gaa gga tgg caa tgt gtt cca aaa      1392
Met Ser Ser Ser Ser Ser Leu Asn Glu Gly Trp Gln Cys Val Pro Lys
        450                 455             460

cca agc cag aga atg gaa cac gaa cag ccc cct gct cac tgc ctt gca      1440
Pro Ser Gln Arg Met Glu His Glu Gln Pro Pro Ala His Cys Leu Ala
465                 470                 475                 480

agc gac ccc gaa gcc cct tca act gtg acc tgg cac cca atg tca aag      1488
Ser Asp Pro Glu Ala Pro Ser Thr Val Thr Trp His Pro Met Ser Lys
                485                 490                 495

ctt cct ggc aac                                                      1500
Leu Pro Gly Asn
            500


<210>   64
<211>   500
<212>   PRT
<213>   Thraustochytrium sp.

<400>   64

Met Gly Pro Arg Val Ala Ser Gly Lys Val Pro Ala Trp Glu Met Ser
1               5                   10                  15


Lys Ser Glu Leu Cys Asp Asp Arg Thr Val Val Phe Asp Tyr Glu Glu
                20                  25                  30


Leu Leu Glu Phe Ala Glu Gly Asp Ile Ser Lys Val Phe Gly Pro Glu
            35                  40                  45


Phe Lys Val Val Asp Gly Phe Arg Arg Arg Val Arg Leu Pro Ala Arg
    50                  55                  60


Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Gly
65                  70                  75                  80


Asn Phe Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Val Pro Val
                85                  90                  95


Asn Gly Glu Leu Ser Glu Gly Gly Asp Val Pro Trp Ala Val Leu Val
            100                 105                 110


Glu Ala Gly Gln Cys Asp Leu Leu Leu Ile Ser Tyr Met Gly Ile Asp
        115                 120                 125


Phe Gln Cys Lys Gly Glu Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu
    130                 135                 140


Thr Phe Phe Gly Val Ala Lys Glu Gly Glu Thr Leu Val Tyr Asp Ile
145                 150                 155                 160


Arg Val Thr Gly Phe Ala Lys Arg Pro Asp Gly Asp Ile Ser Met Phe
```

195

Phe Phe Glu Tyr Asp Cys Tyr Cys Asn Gly Lys Leu Leu Ile Glu Met
       180   185   190

Arg Asp Gly Ser Ala Gly Phe Phe Thr Asp Glu Glu Leu Ala Ala Gly
       195   200   205

Lys Gly Val Val Val Thr Arg Ala Gln Gln Asn Met Arg Asp Lys Ile
     210   215   220

Val Arg Gln Ser Ile Glu Pro Phe Ala Leu Ala Ala Cys Thr His Lys
225   230   235   240

Thr Thr Leu Asn Glu Ser Asp Met Gln Ser Leu Val Glu Arg Asn Trp
       245   250   255

Ala Asn Val Phe Gly Thr Ser Asn Lys Met Ala Glu Leu Asn Tyr Lys
       260   265   270

Ile Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr His Ile Asp
       275   280   285

His His Gly Gly Ala Tyr Gly Leu Gly Leu Leu Val Gly Glu Lys Ile
       290   295   300

Leu Asp Arg Asn His Trp Tyr Phe Pro Cys His Phe Val Asn Asp Gln
305   310   315   320

Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Leu Leu Lys
       325   330   335

Leu Tyr Met Ile Trp Leu Gly Leu His Leu Lys Met Glu Glu Phe Asp
       340   345   350

Phe Leu Pro Val Ser Gly His Lys Asn Lys Val Arg Cys Arg Gly Gln
       355   360   365

Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Lys
       370   375   380

Met Gly Tyr Asp Gln Ala Ser Gly Ser Pro Tyr Ala Ile Ala Asp Val
385   390   395   400

Asp Ile Ile Asp Val Asn Glu Glu Leu Gly Gln Ser Phe Asp Ile Asn
       405   410   415

Asp Leu Ala Ser Tyr Gly Lys Gly Asp Leu Ser Lys Lys Ile Val Val
       420   425   430

Asp Phe Lys Gly Ile Ala Leu Gln Leu Lys Gly Arg Ala Phe Ser Arg

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Met Ser Ser Ser Ser Ser Leu Asn Glu Gly Trp Gln Cys Val Pro Lys
    450                 455                 460

Pro Ser Gln Arg Met Glu His Glu Gln Pro Pro Ala His Cys Leu Ala
465                 470                 475                 480

Ser Asp Pro Glu Ala Pro Ser Thr Val Thr Trp His Pro Met Ser Lys
                485                 490                 495

Leu Pro Gly Asn
            500


<210>  65
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<212>  DNA
<213>  Thraustochytrium sp.


<220>
<221>  CDS
<222>  (1)..(1500)

<400>  65
cct acg ccg ttc ttc tcc cct tca tct tac cct ccg agg gca att tgc        48
Pro Thr Pro Phe Phe Ser Pro Ser Ser Tyr Pro Pro Arg Ala Ile Cys
1               5                   10                  15

ttc atc cct ttc ccg ggc aat ccc ctt gac aac aac tgc aag gct gga        96
Phe Ile Pro Phe Pro Gly Asn Pro Leu Asp Asn Asn Cys Lys Ala Gly
            20                  25                  30

gaa atg ccc ctg aac tgg tac aac atg tca gag ttc atg tgt ggc aag       144
Glu Met Pro Leu Asn Trp Tyr Asn Met Ser Glu Phe Met Cys Gly Lys
            35                  40                  45

gtt tct aac tgc ttg ggc cca gaa ttc gca cgc ttt gac aag tcg aac       192
Val Ser Asn Cys Leu Gly Pro Glu Phe Ala Arg Phe Asp Lys Ser Asn
    50                  55                  60

acc agc cgg agc cct gct ttt gac ttg gct ctg gtg acc cga gtt gtt       240
Thr Ser Arg Ser Pro Ala Phe Asp Leu Ala Leu Val Thr Arg Val Val
65                  70                  75                  80

gaa gtc aca aac atg gaa cac ggc aag ttt cta aac gtt gat tgc aat       288
Glu Val Thr Asn Met Glu His Gly Lys Phe Leu Asn Val Asp Cys Asn
                85                  90                  95

cca agc aaa ggc aca atg gtg ggg gag ttt gac tgt ccc caa gac gcg       336
Pro Ser Lys Gly Thr Met Val Gly Glu Phe Asp Cys Pro Gln Asp Ala
                100                 105                 110

tgg ttc ttt gat ggt tcg tgc aac gac ggc cat atg ccg tat tcc att       384
Trp Phe Phe Asp Gly Ser Cys Asn Asp Gly His Met Pro Tyr Ser Ile
            115                 120                 125

atc atg gaa atc gga ctg caa acc tca ggt gtt ctc acc tcg gtg ttg       432
Ile Met Glu Ile Gly Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu
    130                 135                 140

aag gca ccg ctg act atg gac aag gat gac att ctc ttt cga aac ctc       480
Lys Ala Pro Leu Thr Met Asp Lys Asp Asp Ile Leu Phe Arg Asn Leu
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197

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gat gca agt gct gaa atg gtg cgt cca gac gtg gat gtt cgc ggc aaa      528
Asp Ala Ser Ala Glu Met Val Arg Pro Asp Val Asp Val Arg Gly Lys
                165                 170                 175

acg att cga aac gtg acc aag tgt acc ggc tat gca atg ttg gga aag      576
Thr Ile Arg Asn Val Thr Lys Cys Thr Gly Tyr Ala Met Leu Gly Lys
            180                 185                 190

atg ggg att cac cgg ttc acg ttt gag ttg agc gtt gac ggc gtg gta      624
Met Gly Ile His Arg Phe Thr Phe Glu Leu Ser Val Asp Gly Val Val
            195                 200                 205

ttt tat aaa gga tcc act tcc ttt gga tgg ttc act ccc gag gtg ttt      672
Phe Tyr Lys Gly Ser Thr Ser Phe Gly Trp Phe Thr Pro Glu Val Phe
            210                 215                 220

gct cag caa gct gga ctc gac aac ggg aaa aag acg gag ccc tgg tgc      720
Ala Gln Gln Ala Gly Leu Asp Asn Gly Lys Lys Thr Glu Pro Trp Cys
225                 230                 235                 240

aag act aac aac acc tcg gtt cga aga gtt gaa atc gca tcc gcc aaa      768
Lys Thr Asn Asn Thr Ser Val Arg Arg Val Glu Ile Ala Ser Ala Lys
                245                 250                 255

gga aaa gag cag ctg act gag aag ctt ccc gac gca act aat gct caa      816
Gly Lys Glu Gln Leu Thr Glu Lys Leu Pro Asp Ala Thr Asn Ala Gln
            260                 265                 270

gtt ctt cgg cgt tca gag cag tgt gaa tac ctc gat tac ctc aat att      864
Val Leu Arg Arg Ser Glu Gln Cys Glu Tyr Leu Asp Tyr Leu Asn Ile
            275                 280                 285

gcc cct gac tct ggg ctg cat ggg aag ggc tac gcc cac gga cac aaa      912
Ala Pro Asp Ser Gly Leu His Gly Lys Gly Tyr Ala His Gly His Lys
            290                 295                 300

gac gtt aac ccg caa gac tgg ttc ttc tct tgc cac ttt tgg ttc gat      960
Asp Val Asn Pro Gln Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp
305                 310                 315                 320

cct gta atg cca gga tct tta gga att gaa tca atg ttc cag ctt atc     1008
Pro Val Met Pro Gly Ser Leu Gly Ile Glu Ser Met Phe Gln Leu Ile
                325                 330                 335

gag gcc ttt gcg gtg gac caa aac att cct gga gag tac aac gta tcc     1056
Glu Ala Phe Ala Val Asp Gln Asn Ile Pro Gly Glu Tyr Asn Val Ser
            340                 345                 350

aat ccg acc ttt gcc cat gca cca ggc aaa acg gcg tgg aaa tac cga     1104
Asn Pro Thr Phe Ala His Ala Pro Gly Lys Thr Ala Trp Lys Tyr Arg
            355                 360                 365

ggc cag ctc aca cca aag aac cgt gcg atg gac tgc gag gtg cat atc     1152
Gly Gln Leu Thr Pro Lys Asn Arg Ala Met Asp Cys Glu Val His Ile
        370                 375                 380

gtt tca att acc gcc tcc ccc gag aac ggg ggc tac gtt gac atc gtg     1200
Val Ser Ile Thr Ala Ser Pro Glu Asn Gly Gly Tyr Val Asp Ile Val
385                 390                 395                 400

gcc gat gga gcg ctt tgg gta gat gga ctt cgc gtg tac gaa gcc aaa     1248
Ala Asp Gly Ala Leu Trp Val Asp Gly Leu Arg Val Tyr Glu Ala Lys
                405                 410                 415

gag ctt cga gtt cgt gtc gtt tcg gca aaa cct caa gca att ccg gat     1296
Glu Leu Arg Val Arg Val Val Ser Ala Lys Pro Gln Ala Ile Pro Asp
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198

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                420                    425                    430
gta caa caa cag cca cct agc gca aag gcg gac ccg ggg aaa aca gga       1344
Val Gln Gln Gln Pro Pro Ser Ala Lys Ala Asp Pro Gly Lys Thr Gly
        435             440             445

gtt gca ctt tcg ccc act cag cta cgc gac gtc ctg ctt gaa gtg gac       1392
Val Ala Leu Ser Pro Thr Gln Leu Arg Asp Val Leu Leu Glu Val Asp
        450             455             460

aat cca ttg tat ctt ggt gta gag aac tcc aat ttg gtg cag ttt gag       1440
Asn Pro Leu Tyr Leu Gly Val Glu Asn Ser Asn Leu Val Gln Phe Glu
465             470             475             480

tcg aaa cct gca act tct tca cgt atc gtt tcg atc aaa ccg tgc tcg       1488
Ser Lys Pro Ala Thr Ser Ser Arg Ile Val Ser Ile Lys Pro Cys Ser
            485             490             495

att agt gac ctt                                                        1500
Ile Ser Asp Leu
            500


<210>  66
<211>  500
<212>  PRT
<213>  Thraustochytrium sp.

<400>  66

Pro Thr Pro Phe Phe Ser Pro Ser Ser Tyr Pro Pro Arg Ala Ile Cys
1               5                  10                 15


Phe Ile Pro Phe Pro Gly Asn Pro Leu Asp Asn Asn Cys Lys Ala Gly
            20                 25                 30


Glu Met Pro Leu Asn Trp Tyr Asn Met Ser Glu Phe Met Cys Gly Lys
        35                 40                 45


Val Ser Asn Cys Leu Gly Pro Glu Phe Ala Arg Phe Asp Lys Ser Asn
    50                 55                 60


Thr Ser Arg Ser Pro Ala Phe Asp Leu Ala Leu Val Thr Arg Val Val
65              70                 75                 80


Glu Val Thr Asn Met Glu His Gly Lys Phe Leu Asn Val Asp Cys Asn
                85                 90                 95


Pro Ser Lys Gly Thr Met Val Gly Glu Phe Asp Cys Pro Gln Asp Ala
            100                105                110


Trp Phe Phe Asp Gly Ser Cys Asn Asp Gly His Met Pro Tyr Ser Ile
        115                120                125


Ile Met Glu Ile Gly Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu
    130                135                140


Lys Ala Pro Leu Thr Met Asp Lys Asp Asp Ile Leu Phe Arg Asn Leu
145             150                155                160
```

199

```
Asp Ala Ser Ala Glu Met Val Arg Pro Asp Val Asp Val Arg Gly Lys
            165                 170                 175

Thr Ile Arg Asn Val Thr Lys Cys Thr Gly Tyr Ala Met Leu Gly Lys
            180                 185                 190

Met Gly Ile His Arg Phe Thr Phe Glu Leu Ser Val Asp Gly Val Val
            195                 200                 205

Phe Tyr Lys Gly Ser Thr Ser Phe Gly Trp Phe Thr Pro Glu Val Phe
    210                 215                 220

Ala Gln Gln Ala Gly Leu Asp Asn Gly Lys Lys Thr Glu Pro Trp Cys
225                 230                 235                 240

Lys Thr Asn Asn Thr Ser Val Arg Arg Val Glu Ile Ala Ser Ala Lys
                245                 250                 255

Gly Lys Glu Gln Leu Thr Glu Lys Leu Pro Asp Ala Thr Asn Ala Gln
            260                 265                 270

Val Leu Arg Arg Ser Glu Gln Cys Glu Tyr Leu Asp Tyr Leu Asn Ile
            275                 280                 285

Ala Pro Asp Ser Gly Leu His Gly Lys Gly Tyr Ala His Gly His Lys
    290                 295                 300

Asp Val Asn Pro Gln Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp
305                 310                 315                 320

Pro Val Met Pro Gly Ser Leu Gly Ile Glu Ser Met Phe Gln Leu Ile
                325                 330                 335

Glu Ala Phe Ala Val Asp Gln Asn Ile Pro Gly Glu Tyr Asn Val Ser
            340                 345                 350

Asn Pro Thr Phe Ala His Ala Pro Gly Lys Thr Ala Trp Lys Tyr Arg
            355                 360                 365

Gly Gln Leu Thr Pro Lys Asn Arg Ala Met Asp Cys Glu Val His Ile
    370                 375                 380

Val Ser Ile Thr Ala Ser Pro Glu Asn Gly Gly Tyr Val Asp Ile Val
385                 390                 395                 400

Ala Asp Gly Ala Leu Trp Val Asp Gly Leu Arg Val Tyr Glu Ala Lys
            405                 410                 415

Glu Leu Arg Val Arg Val Val Ser Ala Lys Pro Gln Ala Ile Pro Asp
            420                 425                 430
```

200

```
Val Gln Gln Gln Pro Pro Ser Ala Lys Ala Asp Pro Gly Lys Thr Gly
        435             440             445

Val Ala Leu Ser Pro Thr Gln Leu Arg Asp Val Leu Leu Glu Val Asp
    450             455             460

Asn Pro Leu Tyr Leu Gly Val Glu Asn Ser Asn Leu Val Gln Phe Glu
465             470             475             480

Ser Lys Pro Ala Thr Ser Ser Arg Ile Val Ser Ile Lys Pro Cys Ser
            485             490             495

Ile Ser Asp Leu
            500
```

<210> 67
<211> 1410
<212> DNA
<213> Thraustochytrium sp.

<220>
<221> CDS
<222> (1)..(1410)

<400> 67
```
ggc gat aag tct ttt atg gaa acg tac aac gtg tca gca cct ctg tat      48
Gly Asp Lys Ser Phe Met Glu Thr Tyr Asn Val Ser Ala Pro Leu Tyr
1               5                   10                  15

act gga gca atg gcc aag ggc att gca tcc gcc gac ttg gtc att gct      96
Thr Gly Ala Met Ala Lys Gly Ile Ala Ser Ala Asp Leu Val Ile Ala
            20                  25                  30

gct ggg aaa cgc aag ata ctt gga tcg ttt ggt gcg gga ggg ctg cct     144
Ala Gly Lys Arg Lys Ile Leu Gly Ser Phe Gly Ala Gly Gly Leu Pro
        35                  40                  45

att tcc ata gtc cgt gaa gca ctg gag aaa att caa caa cac ctg ccc     192
Ile Ser Ile Val Arg Glu Ala Leu Glu Lys Ile Gln Gln His Leu Pro
    50                  55                  60

cac ggc ccc tac gct gtt aac ctc att cac tcg cct ttc gac agc aac     240
His Gly Pro Tyr Ala Val Asn Leu Ile His Ser Pro Phe Asp Ser Asn
65                  70                  75                  80

ttg gaa aag ggc aac gtt gac ctc ttt ctc gag atg ggc gtg aca gtg     288
Leu Glu Lys Gly Asn Val Asp Leu Phe Leu Glu Met Gly Val Thr Val
                85                  90                  95

gta gaa tgc agc gcg ttc atg gaa ctc acg gcc cag gtt gtc cgg tac     336
Val Glu Cys Ser Ala Phe Met Glu Leu Thr Ala Gln Val Val Arg Tyr
            100                 105                 110

cgc gcg tct ggt cta agc aaa agt gcg gac ggt tcg att cgc att gct     384
Arg Ala Ser Gly Leu Ser Lys Ser Ala Asp Gly Ser Ile Arg Ile Ala
        115                 120                 125

cac cgt att att ggc aag gtt tcc aga acc gag ctg gca gaa atg ttt     432
His Arg Ile Ile Gly Lys Val Ser Arg Thr Glu Leu Ala Glu Met Phe
    130                 135                 140

att cgt cca gca cca cag cac ctc ctc caa aaa ctc gta gcc tcc ggc     480
```

201

```
Ile Arg Pro Ala Pro Gln His Leu Leu Gln Lys Leu Val Ala Ser Gly
145                 150                 155                 160

gag ctg aca gct gag caa gcc gag ctt gca aca cag gtt ccg gtg gcg   528
Glu Leu Thr Ala Glu Gln Ala Glu Leu Ala Thr Gln Val Pro Val Ala
                165                 170                 175

gat gac att gcg gtc gaa gcc gac tcg ggg ggg cat acc gac aac agg   576
Asp Asp Ile Ala Val Glu Ala Asp Ser Gly Gly His Thr Asp Asn Arg
                180                 185                 190

cct att cac gtc att ctt cct cta atc atc aac cta cgc aac cgt ttg   624
Pro Ile His Val Ile Leu Pro Leu Ile Ile Asn Leu Arg Asn Arg Leu
                195                 200                 205

cat aaa gag ctt gac tac cct tcg cat ctc cgg gta cgt gtg ggt gct   672
His Lys Glu Leu Asp Tyr Pro Ser His Leu Arg Val Arg Val Gly Ala
    210                 215                 220

ggt ggt ggt att gga tgt cct caa gcc gct ctt gca gca ttt caa atg   720
Gly Gly Gly Ile Gly Cys Pro Gln Ala Ala Leu Ala Ala Phe Gln Met
225                 230                 235                 240

ggg gca gcg ttt tta atc act gga acg gtg aac cag ctt gct cgt gaa   768
Gly Ala Ala Phe Leu Ile Thr Gly Thr Val Asn Gln Leu Ala Arg Glu
                245                 250                 255

agt ggc act tgt gac aac gtc cgg tta cag ctc tca aag gcc acg tat   816
Ser Gly Thr Cys Asp Asn Val Arg Leu Gln Leu Ser Lys Ala Thr Tyr
                260                 265                 270

agc gac gtg tgt atg gct cct gct gcc gat atg ttt gac caa ggc gtg   864
Ser Asp Val Cys Met Ala Pro Ala Ala Asp Met Phe Asp Gln Gly Val
                275                 280                 285

gag ctg caa gta ttg aag aaa ggc acg ctg ttc cca agt cgt gct aag   912
Glu Leu Gln Val Leu Lys Lys Gly Thr Leu Phe Pro Ser Arg Ala Lys
    290                 295                 300

aag ctg tac gag ctg ttc tgc aag tat gac tcg ttt gag gca atg ccg   960
Lys Leu Tyr Glu Leu Phe Cys Lys Tyr Asp Ser Phe Glu Ala Met Pro
305                 310                 315                 320

gct gaa gaa ttg caa cgg gtt gaa aag cgg att ttt caa aag tcg ctt   1008
Ala Glu Glu Leu Gln Arg Val Glu Lys Arg Ile Phe Gln Lys Ser Leu
                325                 330                 335

gct gaa gtt tgg cag gag acc agt gac ttt tac att cat cgt atc aag   1056
Ala Glu Val Trp Gln Glu Thr Ser Asp Phe Tyr Ile His Arg Ile Lys
                340                 345                 350

aac cct gag aaa atc aat cgt gct gca agc gat ggc aaa ctg aaa atg   1104
Asn Pro Glu Lys Ile Asn Arg Ala Ala Ser Asp Gly Lys Leu Lys Met
                355                 360                 365

tcg ctt tgc ttt cgc tgg tac ctt ggg ctt tcc tca ttt tgg gcc aac   1152
Ser Leu Cys Phe Arg Trp Tyr Leu Gly Leu Ser Ser Phe Trp Ala Asn
    370                 375                 380

tct ggg gca caa gat cgc gtc atg gac tat caa att tgg tgt ggc cct   1200
Ser Gly Ala Gln Asp Arg Val Met Asp Tyr Gln Ile Trp Cys Gly Pro
385                 390                 395                 400

gct att ggc gct ttc aat gat ttt acc aag ggc acg tac ctt gac gtg   1248
Ala Ile Gly Ala Phe Asn Asp Phe Thr Lys Gly Thr Tyr Leu Asp Val
                405                 410                 415

act gtt gca aag agt tac cct tgt gtg gca cag atc aat ttg caa att   1296
```

202

```
Thr Val Ala Lys Ser Tyr Pro Cys Val Ala Gln Ile Asn Leu Gln Ile
            420                 425                 430

ttg caa gga gct gcg tat ctg aaa cgc ctt ggt gtc att cgt ttt gac      1344
Leu Gln Gly Ala Ala Tyr Leu Lys Arg Leu Gly Val Ile Arg Phe Asp
            435                 440                 445

cgc atg ctg ctg cag gcc gtc gat atc gac gat cct gta ttt act tac      1392
Arg Met Leu Leu Gln Ala Val Asp Ile Asp Asp Pro Val Phe Thr Tyr
    450                 455                 460

gtg ccg acc cag cca ctt                                              1410
Val Pro Thr Gln Pro Leu
465                 470


<210>   68
<211>   470
<212>   PRT
<213>   Thraustochytrium sp.

<400>   68

Gly Asp Lys Ser Phe Met Glu Thr Tyr Asn Val Ser Ala Pro Leu Tyr
1               5                   10                  15


Thr Gly Ala Met Ala Lys Gly Ile Ala Ser Ala Asp Leu Val Ile Ala
            20                  25                  30


Ala Gly Lys Arg Lys Ile Leu Gly Ser Phe Gly Ala Gly Gly Leu Pro
            35                  40                  45


Ile Ser Ile Val Arg Glu Ala Leu Glu Lys Ile Gln Gln His Leu Pro
    50                  55                  60


His Gly Pro Tyr Ala Val Asn Leu Ile His Ser Pro Phe Asp Ser Asn
65                  70                  75                  80


Leu Glu Lys Gly Asn Val Asp Leu Phe Leu Glu Met Gly Val Thr Val
            85                  90                  95


Val Glu Cys Ser Ala Phe Met Glu Leu Thr Ala Gln Val Val Arg Tyr
            100                 105                 110


Arg Ala Ser Gly Leu Ser Lys Ser Ala Asp Gly Ser Ile Arg Ile Ala
            115                 120                 125


His Arg Ile Ile Gly Lys Val Ser Arg Thr Glu Leu Ala Glu Met Phe
    130                 135                 140


Ile Arg Pro Ala Pro Gln His Leu Leu Gln Lys Leu Val Ala Ser Gly
145                 150                 155                 160


Glu Leu Thr Ala Glu Gln Ala Glu Leu Ala Thr Gln Val Pro Val Ala
            165                 170                 175


Asp Asp Ile Ala Val Glu Ala Asp Ser Gly Gly His Thr Asp Asn Arg
```

203

Pro Ile His Val Ile Leu Pro Leu Ile Ile Asn Leu Arg Asn Arg Leu
        195   200   205

His Lys Glu Leu Asp Tyr Pro Ser His Leu Arg Val Arg Val Gly Ala
        210   215   220

Gly Gly Gly Ile Gly Cys Pro Gln Ala Ala Leu Ala Ala Phe Gln Met
225   230   235   240

Gly Ala Ala Phe Leu Ile Thr Gly Thr Val Asn Gln Leu Ala Arg Glu
                245   250   255

Ser Gly Thr Cys Asp Asn Val Arg Leu Gln Leu Ser Lys Ala Thr Tyr
            260   265   270

Ser Asp Val Cys Met Ala Pro Ala Ala Asp Met Phe Asp Gln Gly Val
        275   280   285

Glu Leu Gln Val Leu Lys Lys Gly Thr Leu Phe Pro Ser Arg Ala Lys
    290   295   300

Lys Leu Tyr Glu Leu Phe Cys Lys Tyr Asp Ser Phe Glu Ala Met Pro
305   310   315   320

Ala Glu Glu Leu Gln Arg Val Glu Lys Arg Ile Phe Gln Lys Ser Leu
                325   330   335

Ala Glu Val Trp Gln Glu Thr Ser Asp Phe Tyr Ile His Arg Ile Lys
                340   345   350

Asn Pro Glu Lys Ile Asn Arg Ala Ala Ser Asp Gly Lys Leu Lys Met
        355   360   365

Ser Leu Cys Phe Arg Trp Tyr Leu Gly Leu Ser Ser Phe Trp Ala Asn
    370   375   380

Ser Gly Ala Gln Asp Arg Val Met Asp Tyr Gln Ile Trp Cys Gly Pro
385   390   395   400

Ala Ile Gly Ala Phe Asn Asp Phe Thr Lys Gly Thr Tyr Leu Asp Val
                405   410   415

Thr Val Ala Lys Ser Tyr Pro Cys Val Ala Gln Ile Asn Leu Gln Ile
            420   425   430

Leu Gln Gly Ala Ala Tyr Leu Lys Arg Leu Gly Val Ile Arg Phe Asp
        435   440   445

Arg Met Leu Leu Gln Ala Val Asp Ile Asp Asp Pro Val Phe Thr Tyr

                              204

```
                450                 455                 460
```

Val Pro Thr Gln Pro Leu
465   470

<210> 69
<211> 20
<212> DNA
<213> Artificial sequence

<220>
<223> primer

<400> 69
ggyatgmtgr ttggtgaagg   20

<210> 70
<211> 22
<212> DNA
<213> Artificial sequence

<220>
<223> primer

<400> 70
trttsasrta ytgygaacct tg   22

<210> 71
<211> 20
<212> DNA
<213> Artificial sequence

<220>
<223> primer

<220>
<221> misc_feature
<222> (1)..(20)
<223> n = a c g or t

<400> 71
atgkcngaag gttgtggcca   20

<210> 72
<211> 23
<212> DNA
<213> Artificial sequence

<220>
<223> primer

<400> 72
ccwgaratra agccrttdgg ttg   23

<210> 73
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 73
cggggtaccc gggagccgcc ttggctttgt   30

<210> 74
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 74
aaactgcagc ccgggtccag ctggcaggca ccctg   35

<210> 75
<211> 798
<212> DNA
<213> Shewanella olleyana

<400> 75
atggcagaag gttgtggcca attattgcag ttcttcatgc tgcacattgg tatgcacacc   60

ttagttgaaa acggacgttt ccagccttta gaaaatgctt cacaaaaagt acgttgtcgt   120

ggccaagtac tgccacaaca tggtgaactg acgtaccgca tggaagtcac agaaattggt   180

actcaccctc gcccatacgc caaagccaat attgaaatat tgctcaatgg taaagcggtc   240

gtggacttcc aaaatcttgg ggtgatgatt aaagaagaag gtgaatgtac tcgttacact   300

gccgactcta ctgaaacaca tacaacctca ggcacagtcc aaaaaaacaa cagccacaac   360

acaccagcat cattaaatgc accgttaatg gcacaagtgc cagacttaag tgaaccagcc   420

aataaaggcg ttatcccgct gcaacatgtt gaagcgccta tgctgccaga ctacccaaat   480

cgaacccctg atacgctgcc gttcaccgcg taccatatgt ttgagtttgc aacaggtgac   540

atcgaaaact gttttggacc tgactttagt atttaccggg gctttattcc gccgcgcacg   600

ccatgtggtg acttacagct aacaacccgt gttgttgata ttcaaggtaa acgtggcgag   660

cttaaaaaac cgtcatcgtg tatcgctgaa tatgaagtgc caaccgatgc gtggtatttt   720

gctaaaaaca gtcacgcttc agtgatgcct tactcggtat taatggaaat atcactgcaa   780

cccaacggct tcatctca   798

<210> 76
<211> 1042
<212> DNA
<213> Shewanella olleyana

<400> 76
ggcatgatgg ttggtgaagg tatcggcatg gtagcactta agcgcctaga agatgctgag   60

cgtgatggcg accgtattta ttctgtgatt aaaggtgtcg gcgcttcatc agacggtaaa   120

tttaagagta tttatgcacc gcgccctgaa ggccaagcaa aagcattaaa acgagcttat   180

gatgacgctg gttttgcccc tgaaacagtt ggcttaatcg aagctcacgg tacgggtact   240

gctgcaggtg atgtagccga atttaacggc cttaaatctg tatttggtga aacgatcca   300

actaagcaac acatcgcttt aggttcagtg aaatcacaag tgggtcacac gaaatcaacc   360

206

```
gctggtactg ctggcgtgat taaagctgcc cttgccctgc accataaagt attgccaccg      420

accattaacg tctctaagcc aaaccctaag cttaatgttg aggattcacc gttttttcgtt     480

aataccgaaa cacgcccatg gatgcctcgc cctgacggca ctcctcgccg tgctggtatt      540

agctcgttcg gttttggtgg aactaacttc cacttagtat tagaagaata cacccctgag      600

cacagccatg atgagaaata ccgtcaacgc caagtggctc aaagcttatt aatgagtgct      660

gataataaag cagccttgat tgcagaagtg aataagctaa ctgcagacat cagcgcgctt      720

aaaggcacag ataacagcag cattgaacaa gctgaacttg ctcgcattgc taaactatat      780

gctgttcgca ccatagatac ttcagcagcc cgtttaggtc ttgtggtatc aagccttaat      840

gaattaacca ctcagcttgg tttagcgtta aagcagctta ataatgatgt tgatgcatgg      900

caactgccat cagggactag ctaccgctct tcagcactca tcacgattaa tgcaaaccaa      960

-aaggcgacta aaggtaaaaa agcgactaac gcaccgaaag ttgcagcatt gtttgcaggt     1020

caaggttcac aatacctcaa ca                                              1042
```

<210> 77
<211> 806
<212> DNA
<213> Shewanella japonica

<400> 77
```
atggcggaag gttgtggcca attactgcaa ttctttatgc tgcacattgg tatgcacacg       60

ctcgttgaaa atggccgttt ccaaccactt gaaaatgctt cacaaaaagt gcgttgtcgt      120

ggtcaagttc tgccgcagca cggtgaactg acttaccgga tggaaatcac tgaaattggc      180

attcaccctc gcccatatgc caaagcgaat attgatattt tgcttaacgg taaagcggtt      240

gtcgacttcc aaaacttagg tgtcatgatc aaagaagaaa gcgaatgtac gcgctacctt      300

aatgatacgc ccgctgtcga tgcctcagct gatcgaatta attcagcaac caataatatt      360

ctatacccag cggcttcaac caatgcgcca ctcatggctc aactgcctga tttgaatgcc      420

ccaacgaata aaggcgttat cccactgcaa catgttgaag cgccgataat tccagattat      480

ccaaatcgta ctcctgatac cctgccattc acggcgtatc acatgttcga atttgccact      540

ggcaatattg aaaactgctt tggaccggac tttagtattt accgtggttt cattccaccg      600

cgcacaccat gtggcgactt acagctaacg actcgtattg ttgatattca aggtaaacgt      660

ggcgaattga aaaagccatc atcgtgtatc gcagaatatg aagtgccaac tgatgcatgg      720

tatttcgcta aaaacagcca cgcctcggtc ataccttatt cagtgttgat ggaaatttca      780

ctgcaaccca atggcttcat ctcagg                                           806
```

<210> 78
<211> 1042
<212> DNA
<213> Shewanella japonica

<400> 78
```
ggtatgctgg ttggtgaagg cattggcatg gtggcattaa aacgtcttga agatgctgag       60
```

cgtgacggtg accgtattta ctcagtcatt aaaggggtcg gcgcttcatc tgatggtaag   120

ttcaaatcaa tttatgcacc tcgacctgaa ggccaagcta aagcgctgaa gcgtgcttat   180

gatgacgccg gctttgcacc tgaaaccgtt ggcttaattg aagctcacgg aacaggcact   240

gcagcgggtg atgtggcaga atttaatggt cttaaatctg tatttggtga gaatgactca   300

acaaagcaac acattgcttt aggttcagtt aagtcacaag tgggccatac taaatcaact   360

gcgggaaccg cgggtgtgat taaagcggcg ttagcactgc atcataaagt gctgccgcca   420

accatcaacg tctctaagcc taaccctaag cttaatgttg aggattcacc gtttttcatt   480

aacactgaaa ctcgcccttg gatgcctcgc cctgatggca caccacgccg agctggtata   540

agttcgttcg gttttggtgg cacaaacttc cacttagtac tagaagaata cagcccagag   600

cacagccgtg atgagaaata tcgtcagcgc caagtagcac aaagcttatt gattagcgct   660

gacaataaag ctgagctcat tgcagaaatc aacaagctta cgctgacat cagcgcgctt   720

aaaggcacag ataacagcag catcgaacaa gctgaacttg cccgcattgc taaactatat   780

gctgttcgca ctttagatac ttcagcagtc cgtttgggtc ttgtggtctc aagccttaat   840

gaattaacca ctcaacttgg tttagcgtta aagcagctaa gtaacgacgc tgaagcatgg   900

caattaccat caggtacgag ctatcgctca tctgcgctca tcacgattaa tgccaaccaa   960

aagacgacta aaggtaaaaa agcagctaac acaccgaaag tagcagcatt atttgcaggt   1020

caaggttcgc aatatctcaa ca   1042

<210> 79
<211> 6
<212> DNA
<213> Artificial Sequence

<220>
<223> restriction enzyme site

<400> 79
catatg   6

<210> 80
<211> 192
<212> DNA
<213> Schizochytrium sp.

<220>
<221> misc_feature
<222> (1)..(7)
<223> BspHI restriction site

<220>
<221> misc_feature
<222> (188)..(192)
<223> SacII restriction site

<400> 80
tcatgaagcc ggttgctccg aagttctacg cgcgtctcaa cattgacgag caggacgaga   60

cccgtgatcc gatcctcaac aaggacaacg cgccgtcttc cagctctagc tcctcttcca   120

208

```
gctcttccag ctcttccagc ccgtcgccag ctccgtccgc cccagtgcaa aagaaggctg      180

ctccggccgc gg                                                          192


<210>   81
<211>   717
<212>   DNA
<213>   Nostoc sp.


<220>
<221>   CDS
<222>   (4)..(714)

<400>   81
taa ttg ttg cag cat act tgg cta cca aaa ccc cca aat tta acc tta       48
    Leu Leu Gln His Thr Trp Leu Pro Lys Pro Pro Asn Leu Thr Leu
    1               5               10              15

ttg tca gat gaa gtt cat ctc tgg cgc att ccc ctt gac caa cca gaa       96
Leu Ser Asp Glu Val His Leu Trp Arg Ile Pro Leu Asp Gln Pro Glu
            20              25              30

tca cag cta cag gat tta gcc gct acc tta tct agt gac gaa tta gcc       144
Ser Gln Leu Gln Asp Leu Ala Ala Thr Leu Ser Ser Asp Glu Leu Ala
        35              40              45

cgt gca aac aga ttt tat ttt ccc gaa cat cgc cgg cgt ttt act gct       192
Arg Ala Asn Arg Phe Tyr Phe Pro Glu His Arg Arg Arg Phe Thr Ala
        50              55              60

ggt cgt ggt att ctc cgc agt atc ttg ggg ggc tat ttg ggt gtg gaa       240
Gly Arg Gly Ile Leu Arg Ser Ile Leu Gly Gly Tyr Leu Gly Val Glu
    65              70              75

cca ggg caa gtt aaa ttt gat tat gaa tcc cgt ggt aaa cca ata tta       288
Pro Gly Gln Val Lys Phe Asp Tyr Glu Ser Arg Gly Lys Pro Ile Leu
80              85              90              95

ggc gat cgc ttt gcc gag agt ggt tta tta ttt aac ttg tca cac tcc       336
Gly Asp Arg Phe Ala Glu Ser Gly Leu Leu Phe Asn Leu Ser His Ser
                100             105             110

cag aac ttg gcc ttg tgt gca gtc aat tac acg cgc caa atc ggc atc       384
Gln Asn Leu Ala Leu Cys Ala Val Asn Tyr Thr Arg Gln Ile Gly Ile
        115             120             125

gat tta gaa tat ctc cgc ccc aca tct gat tta gaa tcc ctt gcc aaa       432
Asp Leu Glu Tyr Leu Arg Pro Thr Ser Asp Leu Glu Ser Leu Ala Lys
        130             135             140

agg ttc ttt tta ccg cga gaa tat gaa tta ttg cga tcg cta ccc gat       480
Arg Phe Phe Leu Pro Arg Glu Tyr Glu Leu Leu Arg Ser Leu Pro Asp
    145             150             155

gag caa aaa caa aaa att ttc ttt cgt tac tgg act tgt aaa gag gct       528
Glu Gln Lys Gln Lys Ile Phe Phe Arg Tyr Trp Thr Cys Lys Glu Ala
160             165             170             175

tat ctt aaa gca acg ggt gac ggc atc gct aaa tta gag gaa att gaa       576
Tyr Leu Lys Ala Thr Gly Asp Gly Ile Ala Lys Leu Glu Glu Ile Glu
                180             185             190

ata gca cta act ccc aca gaa cca gct aag tta cag aca gct cca gcg       624
Ile Ala Leu Thr Pro Thr Glu Pro Ala Lys Leu Gln Thr Ala Pro Ala
            195             200             205
```

209

```
tgg agt ctc cta gag cta gtg cca gat gat aat tgt gtt gct gct gtt          672
Trp Ser Leu Leu Glu Leu Val Pro Asp Asp Asn Cys Val Ala Ala Val
        210             215             220

gcc gtg gcg ggt ttt ggc tgg cag cca aaa ttc tgg cat tat tga          717
Ala Val Ala Gly Phe Gly Trp Gln Pro Lys Phe Trp His Tyr
        225             230             235
```

<210> 82
<211> 237
<212> PRT
<213> Nostoc sp.

<400> 82

```
Leu Leu Gln His Thr Trp Leu Pro Lys Pro Pro Asn Leu Thr Leu Leu
1               5               10              15

Ser Asp Glu Val His Leu Trp Arg Ile Pro Leu Asp Gln Pro Glu Ser
            20              25              30

Gln Leu Gln Asp Leu Ala Ala Thr Leu Ser Ser Asp Glu Leu Ala Arg
        35              40              45

Ala Asn Arg Phe Tyr Phe Pro Glu His Arg Arg Arg Phe Thr Ala Gly
    50              55              60

Arg Gly Ile Leu Arg Ser Ile Leu Gly Gly Tyr Leu Gly Val Glu Pro
65              70              75              80

Gly Gln Val Lys Phe Asp Tyr Glu Ser Arg Gly Lys Pro Ile Leu Gly
            85              90              95

Asp Arg Phe Ala Glu Ser Gly Leu Leu Phe Asn Leu Ser His Ser Gln
            100             105             110

Asn Leu Ala Leu Cys Ala Val Asn Tyr Thr Arg Gln Ile Gly Ile Asp
        115             120             125

Leu Glu Tyr Leu Arg Pro Thr Ser Asp Leu Glu Ser Leu Ala Lys Arg
    130             135             140

Phe Phe Leu Pro Arg Glu Tyr Glu Leu Leu Arg Ser Leu Pro Asp Glu
145             150             155             160

Gln Lys Gln Lys Ile Phe Phe Arg Tyr Trp Thr Cys Lys Glu Ala Tyr
            165             170             175

Leu Lys Ala Thr Gly Asp Gly Ile Ala Lys Leu Glu Glu Ile Glu Ile
        180             185             190

Ala Leu Thr Pro Thr Glu Pro Ala Lys Leu Gln Thr Ala Pro Ala Trp
        195             200             205
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Ser Leu Leu Glu Leu Val Pro Asp Asp Asn Cys Val Ala Ala Val Ala
    210   215   220

Val Ala Gly Phe Gly Trp Gln Pro Lys Phe Trp His Tyr
225   230   235